The Welding Engineer

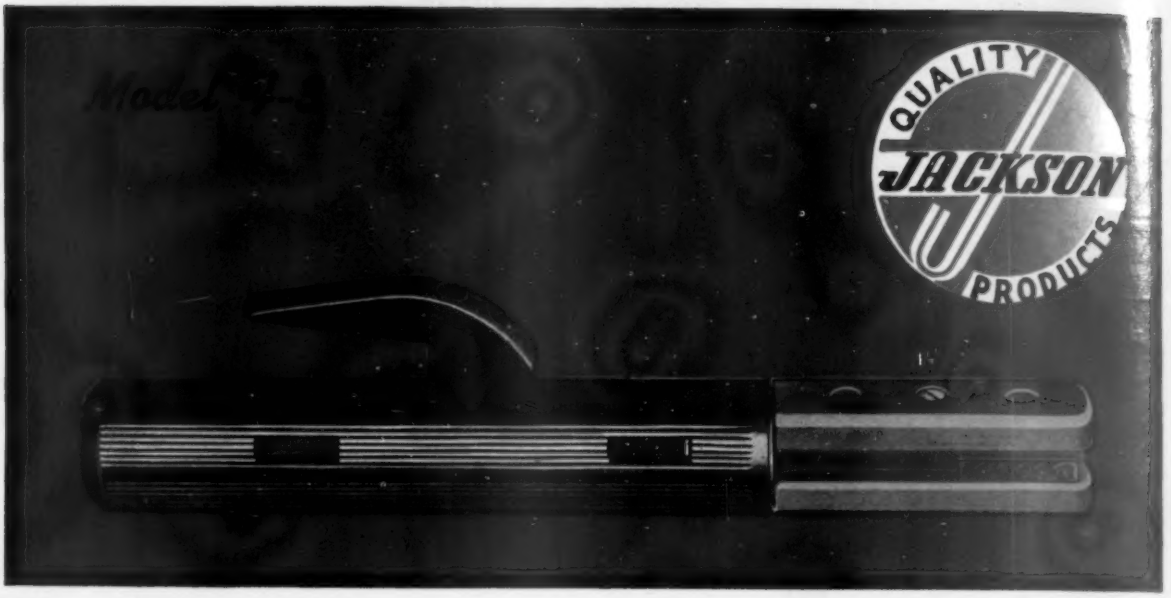
NEER BUSINESS AND TECHNICAL JOURNAL OF THE WELDING INDUSTRY

olume XXV | August, 1940 | Number 8

East Engrg. Library

AUG 12 1940

Welding Steel Deck Plates And Track Fasteners



Model F-3. Fully insulated. 300 Amps. 1/8" to 1/4" rods. Weight 22 oz. Replaceable jaws of Mallory 3 Metal.

NEW

. . . a JACKSON "Streamline" Electrode Holder

Insulated • Safe • Economical

Quick!

This holder is as quick as the tong type —no time lost in adjusting electrodes which are held securely at any angle.

Light—weighs only 22 oz. Correctly balanced, eliminates fatigue. An ideal holder for "hard-to-get-at" places.

Concealed Spring, completely enclosed in vulcanized fibre handle, exerts 80 lbs. pressure on electrode.

Blade Members are made of Mallory 3 Metal. Replaceable jaws of the same metal assure exceptional conductivity and long life.

Mechanical Cable Connection is quickly and securely made, affecting perfect contact.

Insulation is complete, protecting the welder and avoiding work spoilage.

Cool operation assured by complete ventilation of jaw insulation and handle.

Contact your dealer or write to us. Get our holder folder illustrating and describing eight other models —one for every arc welding need.

JACKSON ELECTRODE HOLDER CO.

15122 Mack Avenue **Detroit, Michigan**

Canadian Distributors: Hollup Corporation, Limited, Toronto - Paragon Supplies, Limited, Vancouver

AUGUST, 1940

The Welding Engineer

MEMBER

Associated Business Papers
Audit Bureau of Circulations
American Welding Society
International Acetylene Association

G. H. MACKENZIE
President and Treasurer

RALPH S. KENRICK
Editor

M. S. HENDRICKS
Promotion Manager

» «

Eastern Representative:
T. E. DEPEW, 1834 Broadway, New York, N.Y.
Tel. Columbus 5-7843.

Pacific Coast Representative:
W. R. McINTYRE, 446 Western Pacific Bldg.,
Los Angeles, Calif. Tel. Prospect 0565.

» «

Published on the 10th of each month by The Welding Engineer Publishing Company, 506 South Wabash Ave., Chicago, Ill.
Telephone Webster 7134.

Advertising copy must be received not later than the 5th of each month.

IN THIS ISSUE

Our Front Cover:

"Welding Steel Deck Plates and Track Fasteners"—More than 1000 ft. of butt welds and 1500 plug welds were made in building the decking and attaching the track fasteners at this railroad bridge in Chicago. Photo (General Electric Co.)

Stainless Steel "Carpentry" (Editorial) 17

Welded Composite Structures (Editorial) 17

Sciaky System of Stored Energy Spot Welding 19

Advantages of Low-Alloy Steel for Pressure Vessels (Robert Lattice) 25

Stainless Steel "Carpentry" Vastly Improved by Welding 28

Soft Soldering, Silver Brazing and Gas Welding of High Nickel-Bearing Alloys 30

Brief Sketches of Welding Jobs 34

New Product Developments 39

News of the Industry 42

Personals 42

Trade News 44

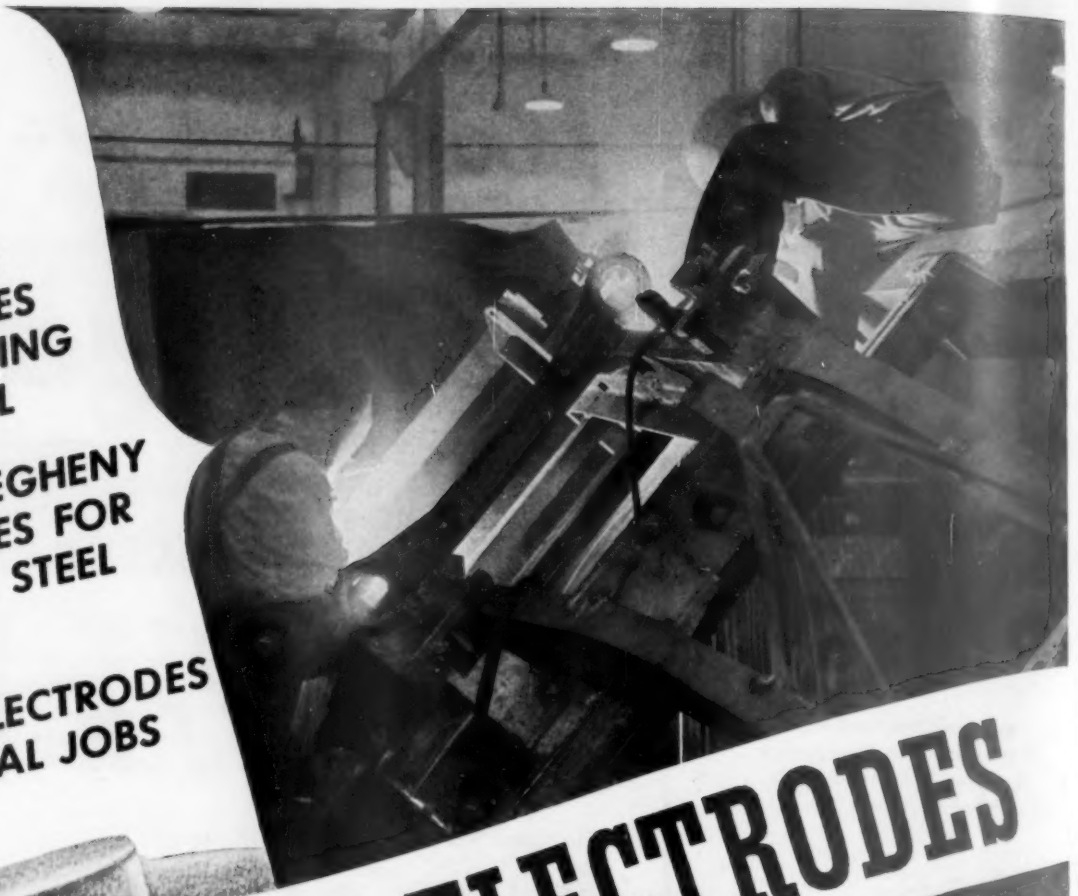
Recent Patents 45

Trade Literature 46

Classified Section 48

Subscription, payable in advance: United States and possessions, and Canada, $3 a year; Foreign Countries, $4 a year; Single copy, domestic, 25 cents; Single copy, foreign, 35 cents. Entered as second-class matter January 20, 1916, at the postoffice at Chicago, Illinois, under the act of March 3, 1879.

FOREIGN REPRESENTATIVES: AUSTRALIA and NEW ZEALAND—R. Hill, Matlock House, Davenport, Auckland, New Zealand; GREAT BRITAIN—A. D. Baynes, 6, Mordaunt House, Larkhall, Clapham, London, S. W. 8, England; SOUTH AFRICA—J. W. Arnison, 35a Victoria Avenue, Benoni, Transvaal, South Africa; JAPAN—Maruzen Company, Ltd., 6, Nihonbashi, Tori-Nichome, Tokyo, Japan; U. S. S. R.—Mesdunarodnaja Kniga, Kusnezki Most 18, Moscow, U. S. S. R.



HI-TENSILE ELECTRODES FOR WELDING MILD STEEL

•

PAGE-ALLEGHENY ELECTRODES FOR STAINLESS STEEL WELDING

•

SPECIAL ELECTRODES FOR SPECIAL JOBS

PAGE ELECTRODES

FOR BETTER WELDS!

● Every Page electrode is made to help you make better welds. The sole purpose of our broad program of research and experiment is to develop better products with which you can do better and more profitable work. • Out of this program have come electrodes that, on actual test, have proved themselves head and shoulders above any electrodes against which they were tested. • So, whatever welding job you have to do, give Page a trial. The results may surprise you.

BUY ACCO QUALITY *in Page Welding Electrodes; Page Wire Fence; Lay-Set Preformed Wire Rope; Reading-Pratt & Cady Valves; Campbell Abrasive Cutting Machines; American Chains; Ford Chain Blocks, Cranes and Trolleys.*

PAGE STEEL AND WIRE DIVISION • MONESSEN, PENNSYLVANIA

AMERICAN CHAIN & CABLE COMPANY, Inc.

AMERICAN CHAIN DIVISION
AMERICAN CABLE DIVISION
ANDREW C. CAMPBELL DIVISION
FORD CHAIN BLOCK DIVISION

HAZARD WIRE ROPE DIVISION
MANLEY MANUFACTURING DIVISION
OWEN SILENT SPRING COMPANY, INC.
PAGE STEEL AND WIRE DIVISION

READING-PRATT & CADY DIVISION
READING STEEL CASTING DIVISION
WRIGHT MANUFACTURING DIVISION
•

In Canada: DOMINION CHAIN COMPANY, LTD.
In England: BRITISH WIRE PRODUCTS, LTD.
THE PARSONS CHAIN COMPANY, LTD.

Stainless Steel Carpentry

THE READER will note from an article on page 28 of this issue that it is possible to do some extremely accurate fabrication with stainless steel sheets as thin as 26 gauge by means of the electric arc. An outstanding feature of this welded fabrication, as described in the article, is the accuracy and finish of the welded carpentry. The use of welding fixtures was an important factor in accomplishing this result. In welding 16 gauge material of 18-8 composition, this fabricator used stainless electrodes of 19-9 composition, with a mercury-vapor rectifier type of low-current welding machine. With 1/32 in. electrode a steady welding current as low as 5 amps. was employed. In the experience of this fabricator, the arc welding of thin stainless sheets has now been developed to the point where the process is of commercial value.

Attention is also directed to the grinding and finishing procedure which is followed on welded stainless steel equipment to be used in a food processing plant. The Department of Agriculture, through its Bureau of Animal Industry, exercises considerable inspection authority and is reported to be pretty darn fussy as to the finish of welded stainless steel equipment for food processing. A stainless steel weld has to be 100% good because any porosity will be exposed by the subsequent finishing operation. The patience and minute attention to finishing details on this type of work gives the welding shop the appearance of a jewelry manufacturing establishment. It is only by strict adherence to this welding and finishing procedure that it is possible to obtain the perfect blending of weld metal and base metal which is demanded by the customer.

Welded Composite Structures

"HALF A LOAF is better than no loaf" goes an old saying and welding-minded men, who are anxious to increase acceptance for structural welding, will surely agree. We note for example, a definite trend in bridge welding toward the acceptance of a composite structure, partly riveted and partly welded. Each of these joining processes is employed where the bridge designer believes it to be the best and most economical process to meet a particular design problem or a specific erection difficulty. From an inspection of some recent railroad bridges at highway crossing grade separations, we have noticed a general acceptance of welded steel deck plates and also welded rail fasteners of a patented rubber cushion design, which obviate the necessity of using wooden ties and stone ballast. Corrosion-resistant steel of low-alloy composition seems to be preferred for bridge decks. By means of welding it is possible to secure a 100% water-tight deck. This is a welcome advance in bridge construction and should no doubt be reflected in reduced maintainance and painting costs.

On a grade separation project now under construction in Chicago, we have noticed the use of a composite girder construction using welded butt seams in the web of the girder with riveted top and bottom chords. Welded vertical stiffeners are used on the web and also welded knee braces to increase the stiffness of the structure. Welded bridge seats have replaced the older type of cast steel seats.

The welding contractor on this project, one of the early pioneers in the use of welding, conceived the idea of using some type of automatic arc welding machine to speed up the downhand welding of the long butt seams for the bridge deck. Knowing that automatic equipment has been used very successfully in shipbuilding and also in boiler and tank fabrication, he reasoned that it could be used with equal effectiveness in field welding. With the cooperation of an equipment manufacturer, he obtained a portable tractor type 400-amp. automatic arc welding machine. This has been used very successfully in speeding up the job and in reducing welding costs. Using a 7/32 in. coated rod, an average speed of about 45 ft. per hour has been achieved.

Experience on this job would indicate that bridge designers should specify the use of a backing strip on downhand welding, in order to expedite the use of an automatic machine. With a backing strip, it is possible to secure 100% penetration without difficulty. On this project alone, there are over 3500 lineal ft, of continuous seams for downhand welding.

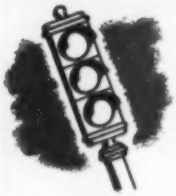
It is thus apparent that small portable automatic equipment can be used effectively on construction work of this character. The more general realization of the economies which are possible by this welding procedure should lead structural engineers to a greater acceptance of welded design. Undoubtedly, the trend will be in this direction and the opportunity for welding employment will increase.

American Duraweld Goggles

STOP *Harmful, Invisible Rays*

...but let Useful Light **GO**

Patented



IT'S A "DEAD END" for invisible infra-red and ultra-violet rays when they come up against Duraweld Goggles. For these eye-searing rays are blocked . . . *scientifically screened out* . . . by the controlled chemical composition of cool-green Noviweld Lenses. And yet non-irritating, working light is freely passed for close work on intricate details.

STOP the danger of "hot sand" in welders' eyes . . . and your work will *GO* faster, better, more profitably. Welders approve the *plus-protection* of Noviweld Lenses, and the lightweight, well-ventilated comfort of Duraweld Goggles. Have your American Optical Industrial Representative show you *this unmatched value in Welding Goggles.*

BUY AMERICAN . . . BY AMERICAN

American Optical Company

SOUTHBRIDGE, MASSACHUSETTS

MANUFACTURERS, FOR MORE THAN 100 YEARS, OF PRODUCTS TO AID AND PROTECT VISION

7587

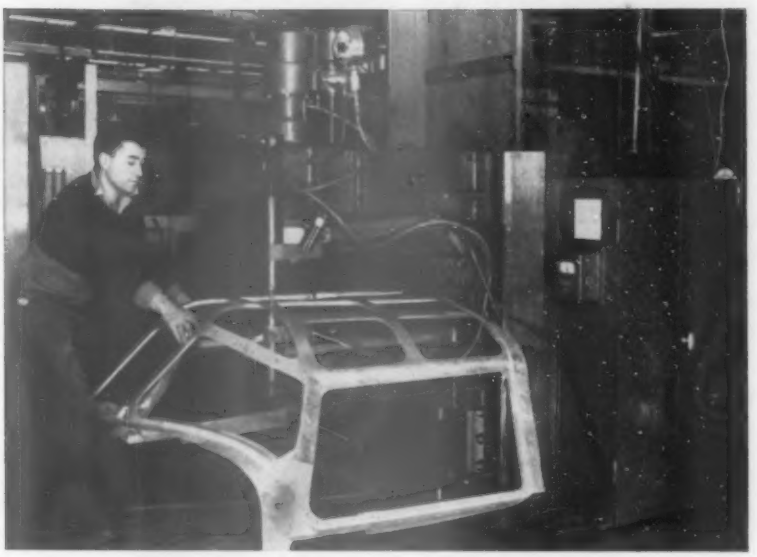


Fig. 1—Using the Sciaky spot welder to fabricate the framing for part of the fuselage. Photo (Consolidated Aircraft Corp.).

Principles of the Sciaky system of

Stored Energy Spot Welding

★ Application of this new idea coupled with variable-pressure cycle produces highly dependable welds in aluminum alloys. Aircraft plants find new process helpful in welding critical alloys.

THE HIGH-CONDUCTIVITY alloys require extremely high welding currents and very short timing. This has led to the application of the principle of stored energy, in either the electromagnetic or electrostatic form, in order to eliminate excessive peak loads on the power supply mains. Aluminum alloys have a critical melting point which makes it necessary to apply welding energy to an extremely accurate degree. This is no simple job because this welding energy is expended in a very brief period of time, consequently any errors in timing can easily lead to considerable inconsistency in weld quality.

It is also important in the case of aluminum and magnesium to control the welding pressure in accordance with a predetermined sequence. It is stated that duralumin, a popular type of aluminum alloy, tends to disintegrate under welding temperatures and loses some of its special properties acquired by heat treatment during the course of its manufacture. With the Sciaky variable-pressure welding process, these negative tendencies are overcome. In short, the use of extremely short weld timing and precise control of welding energy makes it possible to do very critical welding.

PMCO 2S Spot Welder

As shown in Fig. 6, the stored energy type of Sciaky spot welder employs an arrangement of pressure cylinders, welding electrodes, supporting arms and frame structure quite similar in external appearance to the conventional type of spot welder. The vertical movement of the upper electrode is governed by a prismatic slide fitted with a roller bearing to eliminate friction and reduce irregularities in welding. The downward movement of the upper electrode is controlled by means of electro-pneumatic valves. The lower supporting arm slides on a bronze face plate and by means of a jack screw and hand wheel the height of this lower arm can be accurately controlled.

Stored Energy Principle

As stated previously, spot welding of aluminum and its alloys requires a very heavy welding current owing to the low electrical resistance and high thermal conductivity of these metals. Another important point is that with very short timing it is imperative that the supply voltage be constant. This is stated to be a very difficult

Fig. 2—Spot welding part of fuselage on Sciaky welder. Photo (Consolidated Aircraft Corp.)

condition to fulfill in practice, particularly where there are a number of a-c. spot welders in operation. The machines of the a-c. type with timing of 1/120 sec. (half cycle) require an electronic timer such as the Thyratron or Ignitron equipment. With the stored energy machine, the electromagnetic energy is accumulated during a period, less than a second in duration, but this energy is discharged within 1/200 to 3/100 of a second. This transient current in the transformer secondary circuit accomplishes the welding operation, assisted of course, by the variable-pressure control.

Variable-Pressure Cycle

In the Sciaky variable-pressure welder, the sequence of operations is as follows:

1. The work pieces are gripped tightly between the electrodes in order to establish good electrical contact for the welding current.
2. The pressure is decreased automatically an instant before the peak welding current, in order to obtain maximum contact resistance during the peak welding current.
3. Immediately after the current peak, the pressure is increased to a value greater than the yield point of the metal being welded.

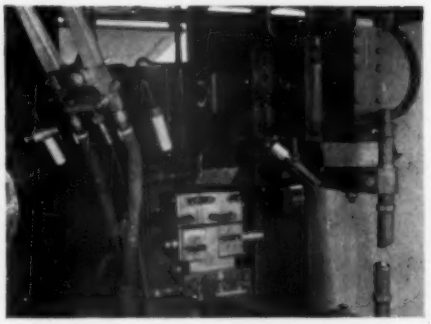


Fig. 3—Close-up of Sciaky machine. Note spotlight used to obtain uniform spacing of spots.

This mechanical working of the metal compensates for the structural changes caused by the temperature rise during welding. All of these operations are accomplished automatically. In the welding of stainless steel or ordinary mild carbon steel, the pressure control is changed so that welding is accomplished under constant pressure.

Comparison of Sciaky and A-C. Systems

Conventional equipment for use in spot welding of the light alloys commonly used in aircraft construction is of the single-phase alternating-current type. The high-voltage low-amperage power of the line supply is transformed by means of a welding transformer to the low-voltage high-amperage current required for welding. In contrast, the Sciaky PMCO 2S/40 spot welder operates on the principle of "stored energy." In this system the welding transformer acts not only as a transformer, with primary and secondary windings, but also as an iron cored choke. It is charged with direct current usually supplied by a mercury arc rectifier operating from a three-phase alternating current power supply. Upon interruption of the charging current in the primary winding, electromagnetic energy stored in the transformer is discharged through the secondary circuit connected to the electrodes.

(1) Welding Current

The welding current of the Sciaky machine is controlled by a maximum current relay which regulates the charging current and thus the accumulated electro magnetic energy. The relay is located in the primary circuit of the welding transformer and trips when the desired current in this circuit is reached, thereby causing the breaker switch to open. The relay which is in a small box readily accessible to the operator is set by turning a knob until the indicating hand rests at the desired value on the dial (calibrated directly in amperes).

On conventional spot welding equipment the welding current is regulated by varying the secondary voltage of the welding transformer. This is accomplished by either (1) taps on the primary side of the transformer which vary the turn ratio, (2) an auto-transformer connected ahead of the welding transformer, by (3) phase control (changing the point at which the power tubes become conductive during each half-cycle). The last mentioned is the most recently developed and requires the least equipment. For this method the control panel consisting of a toggle switch and rheostat dial is contained in a small box which may be located within easy reach of the operator.

The principle of the Sciaky welder is such that the welding current is not affected by any fluctuations of line voltage. With the alternating-current machines, any fluctuation of line voltage will be accompanied by a fluctuation in secondary voltage of the welding

transformer. Furthermore, reciprocal interference because of the peak load set up at the moment of welding may cause inconsistency in welding current.

(2) Time of Current Flow

On the Sciaky welder time of current flow (which in this case is the time of discharge of the transformer) is a function of the resistance in the secondary circuit and is varied by means of removable blocks of different resistances. The following is a table of five key timing periods obtainable with the six blocks supplied:

Table I—Block Combinations and Corresponding Times

Block Combination	Time
1—2	1/100 sec.
1—3	2/100 "
1—4	3/100 "
3—4	4/100 "
5—6	5/100 "

The time of current flow of alternating current machines is positively controlled by electron tubes such as Thyratrons or Ignitrons. Power current is started and interrupted by these tubes in terms of an exact number of cycles in synchronism with the power supply.

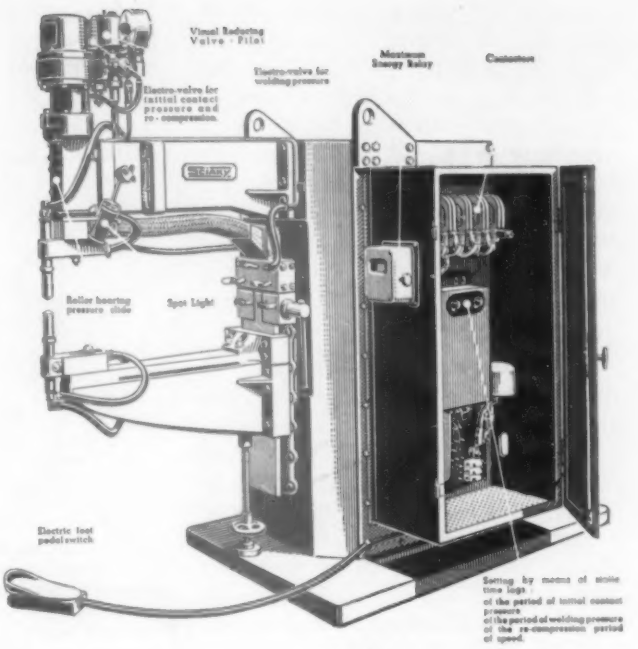

Visual Indicating Valve - Pilot
Maximum Energy Relay
Contactor
Electro-valve for welding pressure
Electro-valve for initial contact pressure and re-compression
Roller bearing pressure slide
Spot Light
Electric foot pedal switch
Setting by means of stroke time logs:
of the period of initial contact pressure
of the period of welding pressure
of the re-compression period
of speed.

Fig. 6—Mechanically, the Sciaky spot welder is quite similar to conventional a-c. equipment.

Any number of cycles from 1 to approximately 30 may be obtained. This method of timing control is extremely accurate.

(3) Electrode Pressure

On both Sciaky and conventional type machines, electrode pressure is applied by air cylinders and pressure regulation is by means of reducing valves. However, on most a-c. machines no provision is made for other than constant pressure throughout the welding cycle, whereas the Sciaky machine provides for employment at will of either constant pressure, or an automatically controlled "variable pressure cycle." The latter cycle consists of a variation of pressure during the welding operation:

(1) The pieces are gripped tightly between the electrodes in order to multiply the number of points through which the welding current will pass.

(2) The pressure is decreased an instant before the current passes so as to obtain the maximum contact resistance during welding.

(3) Immediately after passage of the current, the pressure is increased to the original value, with the idea of working the metal to compensate for the metallurgical changes caused by the temperature rise.

These operations are effected automatically on the machine and require no intervention by the operator. The time intervals between the pressures are controlled by static time relays and may be adjusted as desired.

For aluminum alloys Sciaky recommends that electrode pressure (in lbs. per sq. inch of electrode tip area) be approximately as follows:

Initial and Recompression—58,000 psi.

Welding—23,000 psi.

Recompression is not recom-

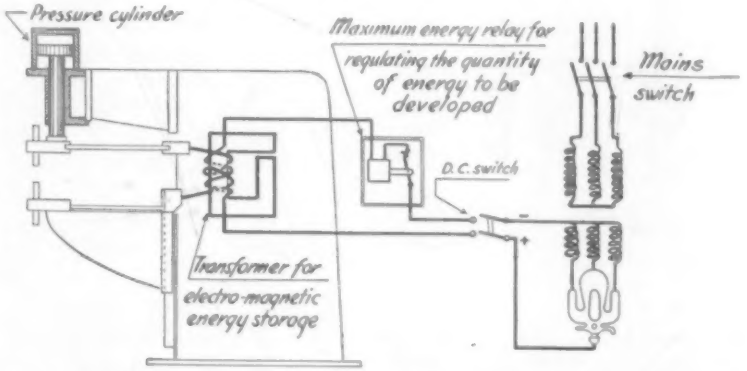

Pressure cylinder
Maximum energy relay for regulating the quantity of energy to be developed
Mains switch
D.C. switch
Transformer for electro-magnetic energy storage

Fig. 4—Simplified circuit sketch of the Sciaky PMCO-2S "stored energy" spot welding machine. Note use of d-c. excitation for transformer primary.

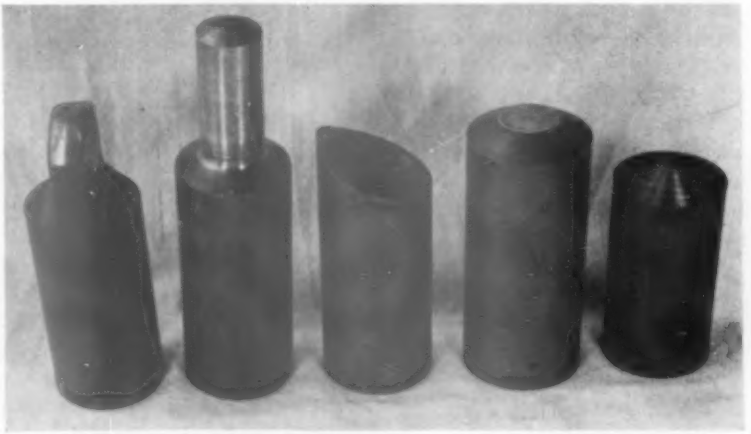


Fig. 5—Types of electrodes as used in aircraft fabrication.

mended for gauge thicknesses of .025 in. and below. It is claimed that the forging produced by recompression will eliminate cracks and, because of the better weld structure produced, will materially increase the ratio of tensile strength to shear strength of spot welds. Results of tests made by aircraft fabricators tend to bear out this contention.

(4) Electrode Characteristics

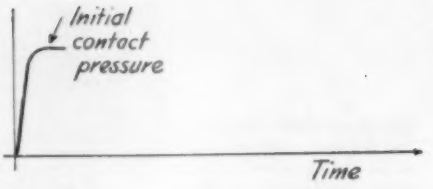
The following are Sciaky's recommendations with respect to electrodes:

All electrodes used in welding aluminum and its alloys should be made from hard drawn electrolytic copper. Any gain in hardness produced by alloying other elements with copper is more than offset by the loss in thermal and electrical conductivity. The reasoning is that the conductivity of aluminum and its alloys is so high, that if the conductivity of the electrodes be any value below that of pure copper, excessive heating of the electrodes is likely to result even with the best of cooling systems. This will cause fouling and softening of the electrodes and production of porous welds.

As massive a shape as possible should be given to the electrodes so as to provide rigidity as well as ample section for passage of the heavy current. Cooling water should reach to within approximately ½ in. of the extremity of the tip, through a tube not less than ¼ in. in diameter. The most common shape given to the tips of the electrode should be that of a truncated cone. The angle of the apex of the cone should be as obtuse as possible (120 deg. or more) in order to reduce heating and indentation in the metal. The surface of the electrode coming in contact with the work can be either flat or slightly domed. The surface of contact should be in proportion to the thickness to be welded. The following figures are given as a guide for 24ST Alclad (aluminum alloy):

Table 2—Electrode Diameters

Sheet Thick. in inches	Dia. of Electrode Tips in inches
.015	3/16
.020	3/16
.025	3/16
.030	3/16
.040	1/4
.045	1/4
.065	5/16
.080	5/16



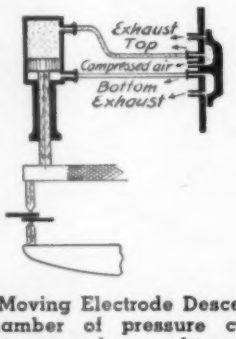


Fig. 7—Moving Electrode Descends.—Bottom chamber of pressure cylinder is opened to atmosphere and top chamber is connected to compressed air supply. Pressure exerted on the work pieces increases and reaches value indicated on graph (initial contact pressure).

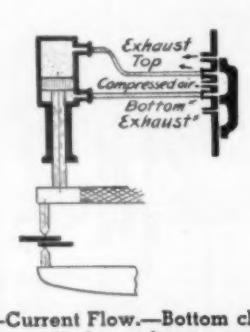


Fig. 8—Current Flow.—Bottom chamber of pressure cylinder, whose cross section area is smaller than that of top chamber, on account of piston rod, is connected to same compressed air supply as top chamber, by means of a further displacement of the valve. Pressure decreases and reaches a value proportionate to difference in cross sectional area of the two chambers. This new pressure value, indicated in Fig. 9, favors the actual welding process.

If it is desired to obtain as little indentation as possible on one side, one electrode having a large flat surface can be used, while the other electrode has a normal diameter tip. When this is done, the current will have to be increased slightly to produce a spot with the same strength as one made using two tips of the same diameter. However, Sciaky does not recommend the practice of using one electrode with a large flat area, except where absolutely necessary. Test results would indicate that welds produced in this manner do not have as good structure as those produced when two normal tip electrodes are used. Several types of electrodes for the Sciaky spot welder are shown in the illustrations.

Electrodes can be cleaned either by rounding off the tips with a file covered with fine emery cloth, or by placing a flat bar covered with fine emery cloth between the tips, applying a very light pressure and rotating the bar around the axis of the electrodes. The cooling of the Sciaky electrodes is efficient due to the mass of metal and the large area exposed to cooling water.

Each manufacturer usually has his own ideas about electrodes and for that reason electrodes used on various a-c. machines differ considerably. Those used on the welding equipment of a prominent aircraft builder are described as follows:

A copper alloy, Mallory No. 3, is used for practically all electrodes. The conductivity of this material is about 85% that of pure copper and its hardness is Rockwell B80 as against approximately B55 for pure copper. The most commonly used electrodes are made from ¾ in. bar stock. The electrode is tapered so that the tip is ⅝ in. in diameter and a hole ⅜ in. in diameter (for water cooling) is drilled from the base to penetrate within approximately ¾ in. of the tip. Normally one flat tip and one 7 deg. (166 deg. included angle) conical tip are used. Electrodes are cleaned with a flat bar covered with fine emery cloth and are periodically reshaped with a lathe.

In the consideration of electrodes it is well to note the importance of efficient water cooling. This is brought out in the following table which shows the decrease in electrical conductivity caused by rising temperature:

Table 3—Conductivity and Temperature

Degrees Fahrenheit	Mallory 3 % Elec. Conductivity	Copper % Elec. Conductivity
68	85	100
212	64	75
392	49	58
572	40	50
752	34	43
932	29	35

If the electrical conductivity is decreased, the welding current will heat up the electrodes much faster

and upsetting or "mushrooming" will result.

(5) Contact Resistance of Parts

The contact resistance of the parts to be welded depends principally on the surface preparation of the parts prior to welding and, with the exception of the pressure applied, is independent of the spot welder used. The temperature rise at the point where the spot weld is to be made is a function of the contact resistance. Therefore, it is only reasonable that the surfaces must be smooth and their resistance as uniform as possible to produce uniform results. Furthermore, the surfaces coming into contact with the electrodes should have a low resistance in order to prevent heating at this point.

Sciaky states that, in general, it is not necessary to clean Alclad aluminum alloy as manufactured in the United States, other than to remove any dirt, oil, grease or other such materials, but that for best results with thin gauge material, it is preferable to clean sheets .025 in. or less in thickness by either chemical or mechanical means prior to welding.

(6) Power Requirements

The direct current to charge the transformer of the Sciaky welder is normally supplied by a mercury arc rectifier capable of a peak output of 400 amp. at 110 volts. In this case the line supply required is three-phase alternating current at 220 volts. Alternating-current machines require single-phase alternating current at either 220 volts, 440 volts or 550 volts depending on the particular equipment.

The power required by the Sciaky welder is approximately 1/10 of that required by alternating-current machines, it is claimed. For example a Sciaky welder having a transformer of only 40 kva. capacity can handle the same work as an a-c. machine of 350 kva. capacity. Alternating-current machines require single-phase current. With the Sciaky machine, three-phase current can be used since rectification balances the three phases. This is an important advantage.

(7) Miscellaneous Features

There are several additional features of the Sciaky machine:

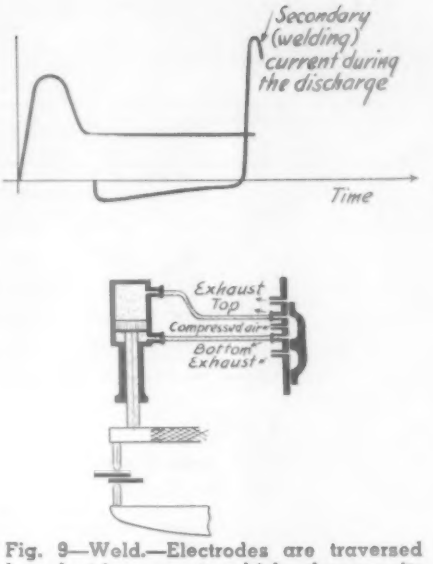


Fig. 9—Weld.—Electrodes are traversed by electric current, which changes its character and increases rapidly; it is during this sudden increase that the weld is effected.

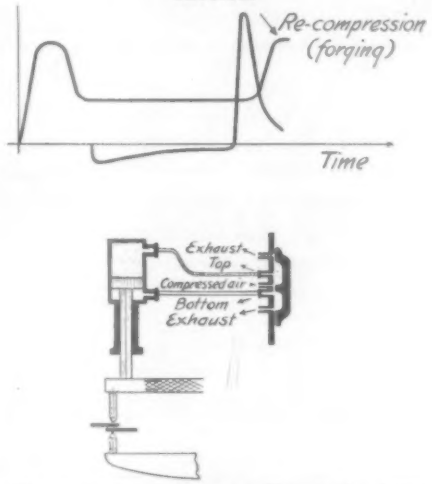


Fig. 10—Recompression (Forging).—Having reached a maximum value, current diminishes very rapidly and tails off in accordance with the exponential law. During this time, bottom chamber of pressure cylinder ceases to be connected to compressed air supply and is open to atmosphere. Thus, pressure upon work pieces increases and a forging action occurs almost instantaneously after passage of welding current.

(a) If auto-continuous operation is desired, all that is necessary is to press a button located to the right of the upper arm. The welder will then operate automatically so long as the foot pedal is depressed. That is, the welding cycle (lowering of the electrode, welding, raising of the electrode) will repeat automatically until the foot pedal is released. The interval between raising and lowering of the electrodes may be adjusted for any value desired. This feature would be useful when necessary to weld several spots in a straight line.

(b) The moving electrode operates in a vertical plane which eliminates any tendency to slide the work between the electrodes at the moment of welding, if both upper and lower electrodes are not in the same plane.

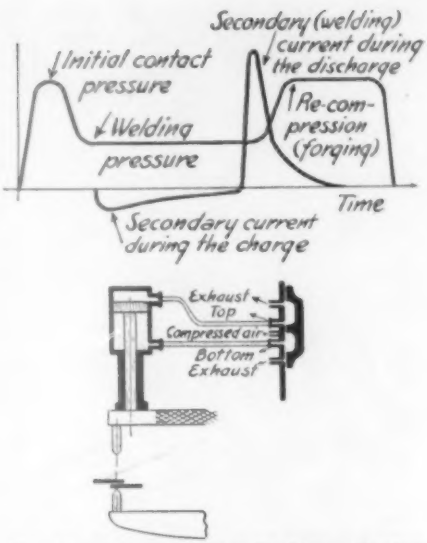


Fig. 11—Return to Rest Position.—During decrease of current, pressure increases and is maintained for a certain period before falling to zero. Bottom chamber of pressure cylinder is thereafter connected to compressed air supply and electrode rises.

To further eliminate stresses on the electrodes at the moment of welding, the connection of the secondary to the moving electrode is by flexible copper strands.

The upper electrode is connected to the pistons of the air cylinders by a precision prismatic slide operating in roller bearings to minimize friction.

(c) To prevent "hammering" of the electrode on the work the descent of the upper electrode is cushioned by an air brake just before contact with the work.

(d) The welding transformer and rectifying equipment are cooled by electric fans. This is another precaution to prevent any current fluctuation.

(e) The electrical circuit is such that welding current cannot flow unless there is effective contact between the electrode and the work and unless the pressure (as previously set) is established an instant before welding.

(f) Spot lights are provided to enable spacing of welds at any desired interval on the metal. The mounting of these lights is sufficiently rigid so that little error in spacing is caused by vibration.

(g) The machine is designed for

ready attachment of a portable spot welding gun. The conductors for this gun are designed so that one cable passes inside the other, thereby practically eliminating the jerk of the gun at the moment of welding and increasing its capacity.

(8) Tests Conducted By User

A prominent aircraft builder on the West Coast has tested a number of specimens on the Sciaky spot welder for determination of shear and tensile strengths. The material for all specimens was 24ST Alclad aluminum alloy sheet. In addition to an etch, the thin gauge (.020 in.) material was sanded lightly with fine emery paper. The special tension specimens noted in Table 4 were developed in order that full diameter (1⅜ in.) electrodes might be used in welding the specimens. It was necessary to use a tip with reduced section to weld the standard tensile specimens due to the one-inch width of this specimen. The special specimen was made as shown in Fig. 15. In tests for comparison of tensile and shear strengths, specimens were welded alternately—one shear, one tensile, one shear, one tensile, etc. In addition, specimens were made for X-ray, cross section and surface appearance examinations. Specimens were also welded using one electrode with a large flat area in order to learn the effect of this practice on spot appearance, strength and structure.

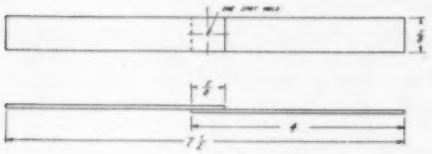


Fig. 12—Single spot shear specimen as used in tests conducted by aircraft fabricator.

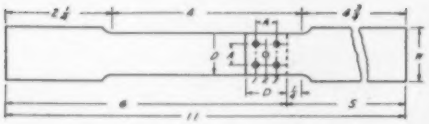


Fig. 13—Multiple spot lap joint shear specimen for test purposes.

(9) Results of Tests

The shear strength values obtained (Table 4) are not necessarily the maximum values which might be obtained since the purpose of these tests was to check uniformity and not maximum strength.

Table 4—Tensile/Shear Ratio of Single Spot Welds in 24ST Alclad Aluminum Alloy

Sciaky D-C Spot Welder

Sheet Thickness (In.)	Primary Current (Amps.)	Pressures Welding (Lbs.)	Pressures Forging (Lbs.)	Current Dwell (Sec.)	Type of Tensile Specimen	Average Tensile Strength (Lbs.)	Average Shear Strength (Lbs.)	Tensile / Shear x 100
0.020	80	110	none	0.025	standard	50	157	31.4
0.040	280	660	2240	0.050	standard	238	588	40.5
0.064	400	660	2240	0.050	standard	542	858	63.2
0.020	90	154	none	0.025	special	62	200	31.0
0.040	245	660	2240	0.050	special	200	565	35.4
0.064	400	660	2240	0.050	special	360	840	42.9

Conventional A-C Spot Welder

Sheet Thickness (In.)	Heat Switch	Control Dial	Welding Pressure (Lbs.)	Current Dwell (Cycle)	Type of Tensile Specimen	Average Tensile Strength (Lbs.)	Average Shear Strength (Lbs.)	Tensile / Shear x 100
0.020	low	22	320	5	standard	61	206	29.6
0.040	low	49	530	9	standard	163	542	30.1
0.064	high	58	800	13	standard	275	925	29.7

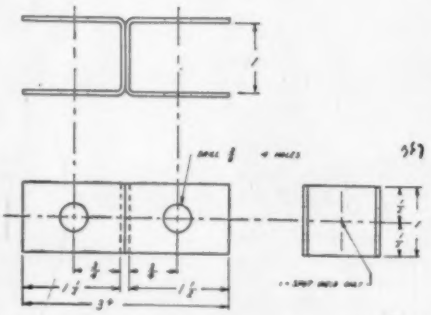


Fig. 14—Standard tension specimen.

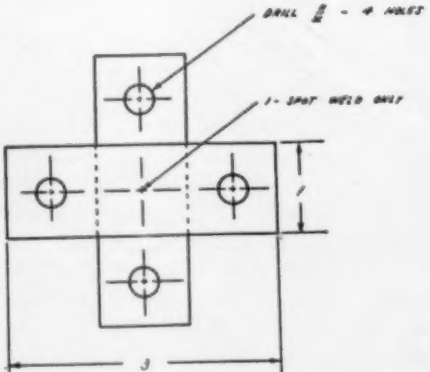
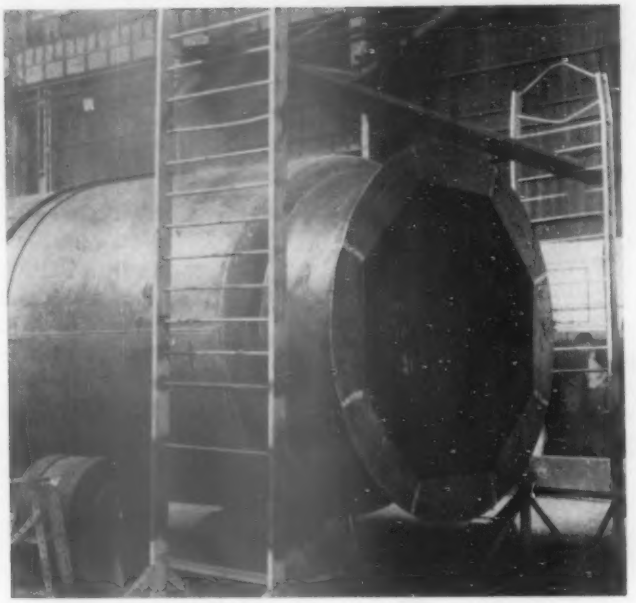


Fig. 15—Special tension specimen.

A few samples of magnesium alloy and stainless steel were welded. These specimens indicated that good welds can be produced in these metals with the Sciaky machine. However, in welding magnesium alloy it is necessary to remove the chrome pickle coating from all surfaces to be welded, because the resistance of the coating is suffciently high to prevent operation of the machine. If resistance between the electrodes exceeds a certain critical value, welding current will not flow.

It will be noted from Table 4 that the tensile / shear ratio is considerably higher for the Sciaky machine than for the conventional a-c. type spot welder. It will also be noted that the ratio is lower for the special tensile specimens than for the standard specimens. It is believed that with the special specimens bending occurs during testing, which tends to tear the spot around the perimeter and that the specimen is therefore not desirable. Consequently, from the results of the relatively few tension specimens made it is indicated that comparison of the two types of machines with respect to tensile / shear ratio should be made on the basis of the standard tensile specimens.



Base plates of this pressure vessel are made from shape-cut plates welded together.

Advantages of low-alloy

Steel For Pressure Vessels

★ Comparison of physical properties of ordinary low carbon with those of the low-alloy high-tensile steels. Relation of shell thickness to preheat temperatures.

By ROBERT LATTICE

THE DRIVING FORCE of economy led the transportation industry to seek ways and means of eliminating operating expenses. As experts pored over voluminous cost analyses in the accounting divisions of railroad and truck transport companies, others skilled in the field of metallurgy were developing a material to meet modern conditions of operation. So was high-tensile steel developed and applied in a transportation industry awake to the fact that reduction of dead load led inevitably to greater fuel efficiencies in terms of cost per ton-mile. And truck tanks as well as tank cars shared the savings made possible by a new material and welded construction.

Were these two fields the only justification for high tensile steel, present day tonnages would be much smaller than they are. Yet another important aspect of present day fabrication entered the scene. Governmental tendencies towards labor increased the cost and importance of man-hours in construction. More expensive material such as high tensile steel led to lower overall cost of pressure vessels by reducing man-hours to the point where a distinct benefit to builder and consumer was evident. Once more the efforts of the government to help labor forced an economic shift that tended in the direction of defeating the purpose of the legislation.

A natural aftermath of the desire of consumers and producers of pressure vessels for application of this new material to their needs was the adoption of this steel by the pressure vessel codes. The API-ASME code and the ASME code recognized the material as ASTM A-149 and A150 or ASME S26 and S27 respectively. Note the apparently different specifications for the same material. Here again is the foremost hurdle in welding's path of progress. The

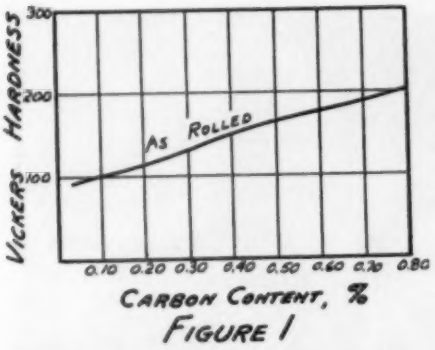


Fig. 1—How hardness is influenced by carbon content (in the as-rolled condition).

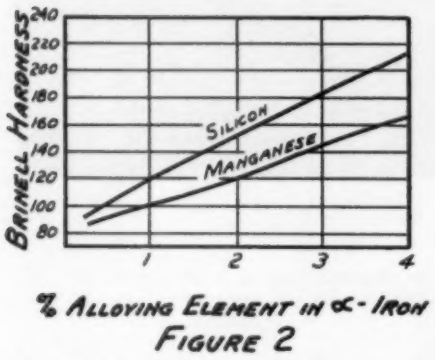


Fig. 2—How silicon and manganese affect hardness of "alpha" iron.

existence of two pressure vessel codes is bad enough. But add to that numerous state codes accepting the ASME code with some minor reservations and you have an ungodly mess. Similarly, the ASME could render a distinct service to pressure vessel manufacturers and puzzled state and insurance company inspectors by adopting ASTM numbers where such exist. Perhaps this forward step would encourage the states to use the ASME code latest revision without the annoying minor changes.

What is this high-tensile steel? Wherein does it differ from the ordinary steel used for boilers and other pressure vessels? Why is there a cost premium? All these are good questions that deserve proper investigation.

First, let us consider ordinary steel such as that used in boilers and other stationary pressure vessels. This is ASTM A70-39 the last two figures in the ASTM number signifying the year of adoption. Essentially a low-carbon steel, this material possesses excellent physical properties with accompanying perfect weldability. No precautions are demanded for the welding of this material, with the exception of the simple safeguard of preheating in the heavier thickness ranges.

As compared with this low-carbon steel, high-tensile steel for code application usually means ASTM A212-39 (formerly ASTM A149 and A150). Here is found higher carbon along with a slight increase in manganese plus a small amount of silicon. All of these materials are strength promoting and account for the difference in tensile strength of the two specifications. Furthermore, as shown in Figures 1 and 2, all of these elements tend to increase the hardness of the steel. Due attention will be paid to the method of keeping the hardness to a minimum later.

Chemical Analysis

Now remember we have two types of steel from which boilers and other pressure vessels may be made. The low-carbon steel with ordinary strength is ASTM A70. The higher carbon, more properly medium-carbon, steel is ASTM A212. In Table 1 are listed the chemical requirements of the two specifications:

On the whole there appears to be little difference in the chemical analyses of the firebox grades of the two steels. There is more carbon. Increasing the carbon tends towards a harder, less ductile steel with the added possibility of cracks under unfavorable welding conditions. The manganese is up with similar leanings in the direction of increased hardness. There is some silicon present with like influences. Still the steel is readily welded with simple precautions.

How strong is high-tensile steel? This is answered in Table 2 where the physical properties of the two materials are listed. There is no paradox in the listing of elongations in Table 2 as compared with the statements in the preceding paragraph. Although the ductility requirements for the stronger steel are more stringent than specifications for ordinary strength material, the actual results show the lower carbon steel to be more ductile. Now the mills exceed the elongation requirements for both materials. But they better the figures for the mild steel by a greater margin than for the higher carbon steel. And the ASTM-A70

Table 1—Chemical Analyses of Low-Carbon and High-Tensile Steels*

	ASTM A70	ASTM A212 Grade A	ASTM A212 Grade B
Carbon, max., per cent			
For plates ¾ in. and under in thickness	0.25		
For plates over ¾ in. to 4 in., incl., in thickness	0.30		
For plates 1 in. and under in thickness		0.28	0.31
For plates 1 to 2 in., incl., in thickness		0.31	0.33
For plates over 2 to 4½ in., incl., in thickness		0.33	0.35
Manganese, max., per cent	0.80	0.90	0.90
Phosphorus, max., per cent	0.035	0.035	0.035
Sulfur, max., per cent	0.04	0.04	0.04
Silicon, per cent		0.15-0.30	0.15-0.30

*Firebox grades and basic open hearth steel.

Fig. 3—Manhole openings are flame-cut after the seams have been welded. This minimizes distortion and aids fabrication.

Fig. 4 — Low-alloy high-tensile shells are carefully checked before welding to make certain that they are truly round.

Table 2—Physical Properties of Low-Carbon and High-Tensile Steel*

	ASTM A70	ASTM A212 Grade A	ASMA A212 Grade B
Tensile strength, psi	55,000 to 65,000	65,000 to 77,000	70,000 to 82,000
Yield point, min., psi	0.5 tens. str.	0.5 tens. str.	0.5 tens. str.
Elongation in 8 in., min., per cent	1,550,000 / tens. str.	1.600,000 / tens. str.	1,600,000 / tens. str.

*Firebox grades

material has greater inherent ductility because of its analysis. In Table 3 are typical analyses and physicals taken from a mill test report for firebox steel in ASTM-A70 and ASTM-A212 Grade B ranges:

Table 3—Typical Steel Mill Reports for Low-Carbon and High-Tensile Steels

	ASTM A70	ASTM A212
Carbon	0.19	0.29
Manganese	0.49	0.80
Phosphorus	0.011	0.014
Sulfur	0.025	0.025
Silicon		0.21
Ultimate strength, psi	58,150	81,300
Yield point, psi	33,220	52,700
Elongation in 8 in., per cent	29.6	25.0

However, this discussion of relative ductilities is not meant to imply an inadequacy of ductility in the high-strength material. On the contrary this medium-carbon material is an excellent steel from every point of view.

In fact with respect to low-temperature impact, the medium-carbon steel is much better than the lower carbon variety. For at low temperatures, such as —50 deg. F., ordinary low-carbon steel has but little resistance to impact. Not so the silicon-killed high-strength steel. At this low temperature, the impact resistance of the high-strength steel is more than three times that of the ordinary strength steel.

Now for a consideration of welding procedure. For high-strength steel it is necessary to use a high-strength electrode conforming to the American Welding Society Filler Metal Specifications Grade 4. All the major electrode manufacturers have such electrodes with the usual composition depositing weld metal with about one-half a percent of molybdenum. These electrodes are commonly known as carbon-moly types.

Knowing the electrode to use brings us to the only phase of the welding procedure that deserves more detailed consideration. The rate of heat extraction from the fusion zone will determine the hardness of the structure at that point. So increasing the section of this medium-carbon steel increases the tendency toward a hard heat-affected zone with low ductility. As the thickness increases, the degree of preheat must be increased. Best practice indicates a preheat of 200 deg. F. for material from 1 to 1½ in.; of 300 deg. F. for material from 1½ to 2½ in.; and a preheat of 400 deg. F. for material over 2½ in. in thickness. In this manner the rate of cooling will be retarded so as to allow transformation to a ductile (pearlitic) structure suited to pressure vessel service.

In the old days we estimated the preheat temperatures from the violence of boiling saliva deposited on the surface of the steel (all tobacco chewers were quite adept at it). Now we have a scientific aid in the form of Tempils. These accurately mixed salts have a sharp melting point, within 15 deg. F. of the preheat temperature for which they are intended. Costing but ten cents each they present a fast and sure method of determining preheat temperatures. If they were available in stick form like hotchalk, the cost of using them would be even less.

The comparative shell thicknesses for pressure vessels made of low and high-tensile steels are given in Table 4. From the overall size of the vessel an idea may be had of the economies to be effected. Weight savings added to labor cost reductions make the use of this stronger steel very much worthwhile in some services. Greater ratio of yield point to ultimate strength enhances the design value of the medium-carbon steel in the direction of an added factor of safety.

Table 4—Comparative Thicknesses in Inches of Low-Carbon and High-Tensile Steels

ASTM A70	ASTM A212 Grade A	ASTM A212 Grade B
1.000	0.836	0.785
2.000	1.697	1.573
3.000	2.540	2.355
4.000	3.481	3.140

Although the API-ASME code recognizes only the high-tensile steel reported in this article, the ASME code recognizes ASTM A202-39, which is a chrome-manganese-silicon alloy steel for boilers and other pressure vessels. Then there are many trade steels of the low-alloy variety which are not yet available for pressure vessel service, even though the railroads are using increasing tonnages for freight cars. Non-code truck tanks have been successfully fabricated of these same high-strength mildly corrosion-resistant materials.

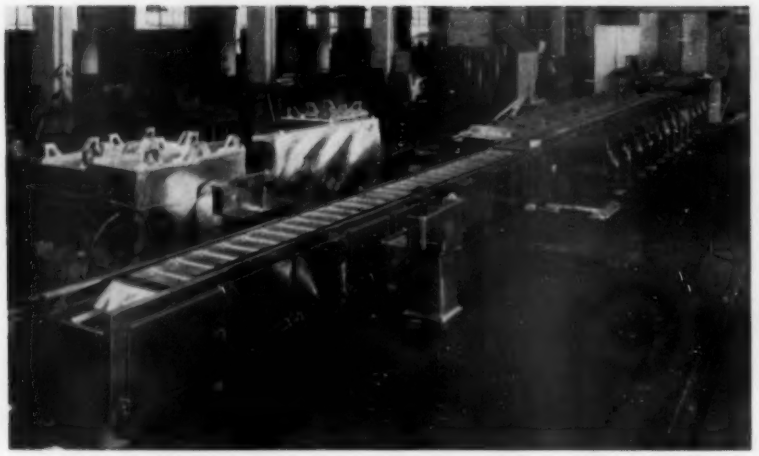


Fig. 1—How the assembled conveyor unit looked before shipment to the customer. Photo (Republic Steel Corp.).

Stainless Steel "Carpentry" Vastly Improved By Welding

★ One of the biggest pieces of stainless steel equipment fabricated entirely by welding, has recently been completed by Allbright-Nell Co., 5323 S. Western Ave., Chicago. This huge machine is essentially a continuous conveyor with abutting work tables, 12 on each side of the conveyor. The entire unit is for the purpose of inspection, evisceration and cleaning of chickens on a production basis. It will be used by a prominent food products company.

Briefly, the production sequence of the conveyor table will be as follows: The pan conveyor at the left will carry the chickens in front of government inspectors for individual inspection of each bird. They will then continue to the head and feet removing saws built integral with the table structure. After this operation, the birds will be placed alternately on the side belts of the eviscerating table, which in itself is a three-belt conveyor with abutting work tables. The two outer stainless steel belts will convey the chickens to the work tables, where operators will remove them for evisceration and cleaning. The operators will then place the chickens on the center stainless steel belt which will carry them to the rinsing trough shown at the right in Fig. 2. Here the chickens will be thoroughly rinsed by being passed through a rinsing chamber where high-pressure water jets will be played against them. Here also, inspectors will be in constant attendance to make sure that all birds are suitable for further processing.

Figure 3 shows a closeup of one of the stainless steel work tables. These are really sinks with a drain at one end to carry away the viscera, blood and rinsing water. The three small welded stainless boxes suspended at the left end of the work table are provided for the purpose of sorting out livers, gizzards and fat pieces. A rinsing spray is played across the work table through a series of small holes drilled into the welded header at the left end of the table.

This unusual piece of equipment is fabricated entirely of 18-8 stainless (Republic Enduro) of 8, 10, 12, 14, 16 and 26 gauge. Even the structural members of the conveyor frame are formed from 12 gauge stainless. The lighter gauges are used for the work tables, inspection doors and trim. From a welding standpoint, an outstanding feature of this chicken cleaning table is the accuracy and finish of the stainless steel "carpentry." Conveyor pans, inspection doors, moulding trim, etc., have been very accurately formed from stainless sheet with the aid of bending dies and both the arc and atomic hydrogen welding processes. This work was facilitated by using carefully designed welding fixtures.

Welding Data

Even the 16 gauge material has been arc welded using 1/16 - 5/64 and 3/32 in. shielded arc electrodes of 19-9 composition. These Acme "Fuzon" electrodes were obtained from Acme Welding Supply Co., Chicago. On the 1/32 - 1/16 in. - 6/64 and 3/32 in. electrodes, this fabricator uses an Allis-Chalmers mercury vapor rectifier type of welding machine. This unit furnishes stable welding currents from 5 to 75 amps. for these smaller electrodes. When using 5/64 - 3/32 - 1/8 stainless electrodes, this fabricator also employs a P & H Hansen arc welder. Arcos "Chromend K" 1/32 (19-9) electrodes are used for patching up porous welds on thin stainless sheets. The arc welding of thin stainless sheets has been developed to the point where the process is now definitely of commercial significance. It will be noted in the illustrations that there is no evidence of warping or buckling in any part of this huge conveyor assembly.

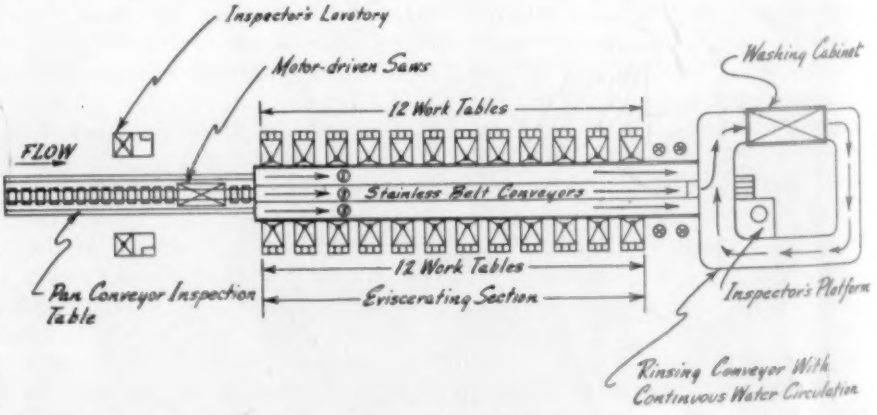


Fig. 2—Simplified plan view of production set up for inspection, evisceration and cleaning of chickens.

Fig. 3—The rinsing conveyor is at extreme right. Abutting work tables (12 on each side) are seen along belt conveyor. Inspection table in foreground. Photo (Republic Steel Corp.)

In order to reduce the friction between the stainless steel conveyor belt (.024 in. thick) and the supporting table, the designer utilized a Monel plate directly under the stainless belt. This Monel plate was butt-welded intermittently to the stainless steel structural members. The difference in thermal expansion and contraction of Monel and stainless steel made it necessary to employ intermittent welding. The coefficient of friction between Monel and stainless is of course much lower than between two sheets of stainless.

Finishing Procedure

The grinding and finishing of stainless steel welds involves considerably more labor and shop overhead than is the case with stainless steel welding. Hence the continued interest in grinding wheels which give promise of cost reduction. Particularly is this true in the fabrication of welded equipment for the food industries, because the Department of Agriculture (Bureau of Animal Industry) is pretty darn fussy as to the finish of welded stainless steel equipment. Fabricators who think their customers are fussy, really don't know the full meaning of the word "fussiness" until they have had to meet B. A. I. inspection.

Allbright-Nell is using two wheels on stainless steel weld grinding in order to bring the job from the rough to the semi-finished state. This work is being done with a Chicago* mounted wheel, 120 grain grade 0, V/T Super-Bond, ¾ in. x 2½ in. mounted on a ¼ in. shank, and a 46 grit rubber-bonded wheel 3 in. in diameter and ¼ in. thick. These wheels are operated at 17,000 r.p.m. using a pneumatic grinder.

The next finishing step is to use a soft flexible canvas wheel with No. 60 polishing grit, then the same wheel with No. 120 grit followed later with 180 grit size. After these three polishing operations, a high-speed wick wheel with greaseless compound is used to provide a "semi-finish." The various parts of the equipment are then assembled in the shop for final inspection. Following inspection, the equipment is disassembled and the final polishing finish is applied, using a slow-speed wick wheel with greaseless compound. With a 6 in. wheel, speeds will average 600 r.p.m. in this slow-speed polishing. Smaller diameter wheels would run at correspondingly higher speeds. The next step in finishing is the "passivation" of the stainless steel by treatment with nitric acid. Following this chemical treatment, all surfaces are polished with Bon-Ami, after which linseed oil or lard oil is applied to preserve and protect the finish during shipment.

Perfect Blending

By following this procedure on a stainless steel weld, no difficulty is experienced in obtaining perfect "blending" of the weld metal and base metal. This was formerly quite a problem. Proper "blending" is very important to fabricators of stainless steel when the customer demands that the weld must not show.

*Chicago Wheel & Manufacturing Co., 1101 W. Monroe St., Chicago.

New Products

Commonwealth A-C. Arc Welders

★ **Commonwealth Electric Welder Mfg. Co.**, 3200 Oxford St., Philadelphia, Pa., has developed four models of a-c. arc welders, covering all welding requirements from light sheet metal to heavy production work. These new machines incorporating exclusive engineering and construction features, have maximum capacities of 80, 150, 200 and 300 amp., stepping down with ample convenient heat taps to 20 amp.

Due to the use of double fibre-glass insulated magnet wire and glass insulation thruout, the coils are non-deteriorating;—impervious to moisture, heat oil and acid. All models are recommended for continuous, day-after-day operation without danger of overheating or burning out. Unexcelled performance, an easy-to-strike, smooth stable are, the complete elimination of magnetic blow, combined with the absence of any dials, meters, or moving parts, makes these machines ideal for use by an unskilled or occasional operator.

Operating economies have been further increased by the use of low-loss silicon steel in the cores and no maintenance or service is normally required during the life of the welder, it is claimed. Low primary loads make it possible to plug the machines into practically any standard power circuit without special wiring.

Every welder is sold on a no-risk trial basis and includes all necessary accessories. The manufacturer guarantees the machines for one year against defects in materials and workmanship and for five years against burning out or mechanical failure under any operating conditions. This guarantee provides "Any machine failing to perform satisfactorily under this guarantee will be replaced or repaired without charge to the customer."

Commonwealth a-c. arc welder.

Fig. 5—Silver brazing a 45-mesh Monel wire cloth to a filter cylinder. See Fig. 6 for finished seam. Photo (International Nickel Co.)

Soft soldering, silver brazing and gas welding of

High Nickel-Bearing Alloys

★ Joint types fully covered and best procedures for joining these metals clearly explained — Flame adjustment — Surface preparation.

THE JOINING processes that are used widely for steel are applicable, with or without slight modification, to non-ferrous metals and alloys such as Monel, nickel and Inconel.

Sometimes several different joining processes may be used in fabricating a single piece of equipment. In general the highest temperature process should be carried out first and the lowest temperature process last. Fig. 1 shows graphically the temperatures to which the parent metal must be heated to effect a joint by each of the various processes.

Soft Soldering

Soft soldering is one of the oldest of the commonly used methods of joining. Its usefulness for joining the strong, corrosion resisting materials, Monel, nickel and Inconel, is limited to those applications where soft solder is not corroded readily. Soft solder is inherently of low strength, and usually dependence for strength must be placed on mechanical joints, such as riveted, lock seamed or spot welded joints, with the soft solder acting only as a sealing medium. The process is limited usually to joints in sheet metal not more than .050 in. or .062 in. thick, because other processes yield stronger joints in these and heavier gauges.

In Table I are given the composition and melting points of soft solders commonly used on corrosion resisting equipment. Of these, the 50-50 and the 60-40 tin-lead solders are used most widely. The trade uses the 60-40 rather than the eutectic 63-37 composition. Pure tin is justified only where corrosion conditions demand its application.

Table I—Commonly Used Soft Solders*—Their Melting Points and Shear Strengths

	Temperature Complete Liquefaction	Complete Solidification	Shear Strength psi.
Pure Tin	450° F.	450° F.	2865
63-37 Tin-Lead..	359° F.	359° F.	6230
50-50 Tin-Lead..	414° F.	359° F.	5740
40-60 Tin-Lead..	460° F.	359° F.	4975

*International Tin Research and Development Council.

Only those soft soldering fluxes known in the trade as "acid" fluxes are recommended for use with Monel, nickel or Inconel. Rosin is not suitable since its cleaning action is too mild. The proprietary or "cut acid" fluxes commonly used for copper are adequate for the soft soldering of Monel and nickel, but a somewhat stronger flux is required with Inconel because of its chromium oxide film. In general,

Fig 1 — Parent metal temperature required for joining process.

proprietary soft soldering fluxes are to be preferred largely because of convenience. There are available a number of such fluxes.

"Cut acid" flux for Monel and nickel is made by adding pure zinc to commercial hydrochloric acid (muriatic acid) and allowing the reaction to come to equilibrium in the presence of a slight excess of zinc. A small amount of ammonium chloride is added sometimes to improve the fluxing action.

All traces of flux should be removed after the soldering operation has been completed.

Joint Types

The many types of mechanical joints used in making equipment of sheet metal, usually not thicker than .050 in. (18 ga. U.S.S.) or .062 in. (16 ga. U.S.S.) are shown in Fig. 2. The maximum gauge for which each type of joint should be used is indicated. Mechanical joints should be used where possible with the soft solder merely a sealing medium. Compared with the strength of the sheet material, a soldered joint is weak indeed.

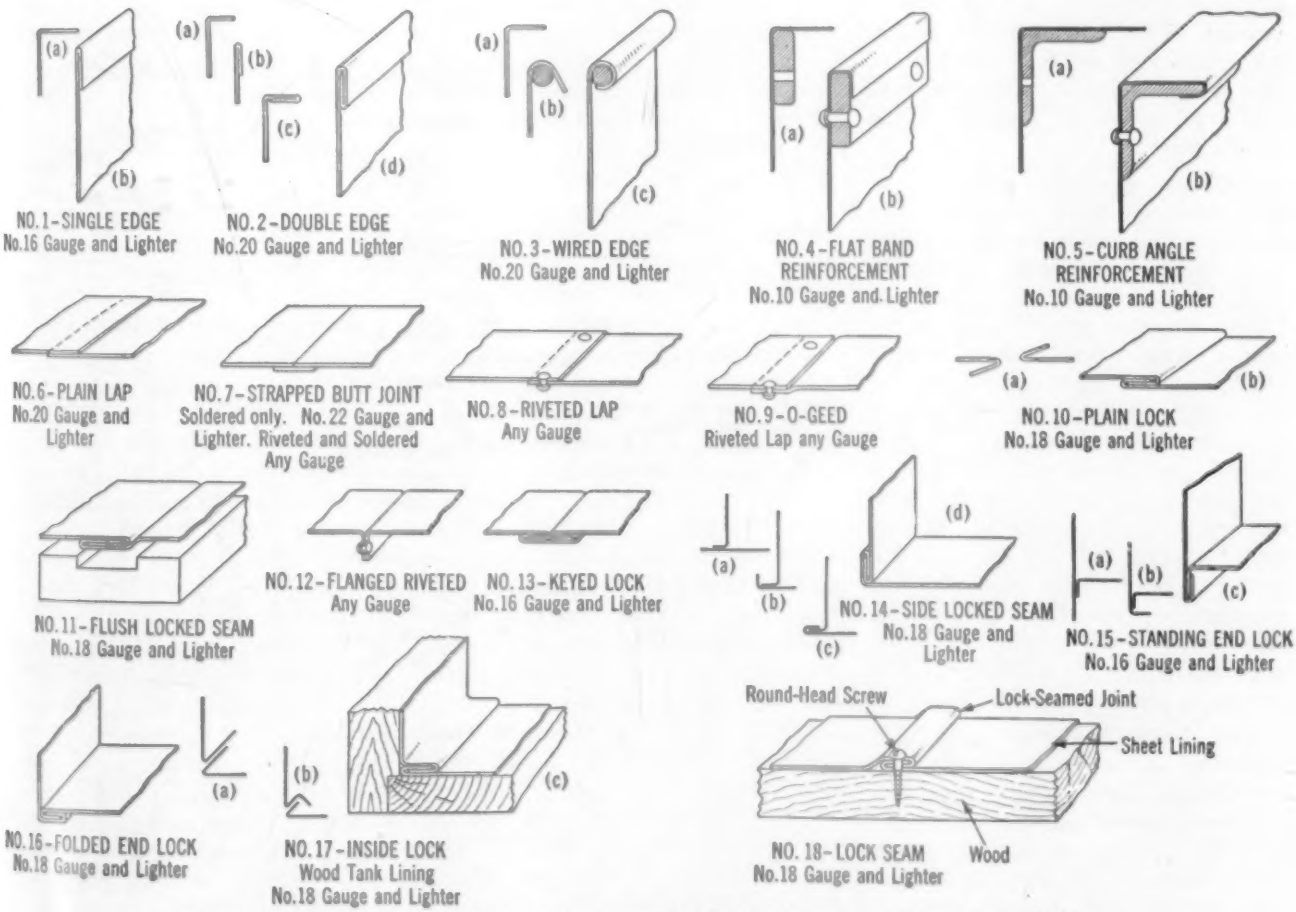

NO. 1 - SINGLE EDGE
No.16 Gauge and Lighter
NO. 2 - DOUBLE EDGE
No.20 Gauge and Lighter
NO. 3 - WIRED EDGE
No.20 Gauge and Lighter
NO. 4 - FLAT BAND REINFORCEMENT
No.10 Gauge and Lighter
NO. 5 - CURB ANGLE REINFORCEMENT
No.10 Gauge and Lighter
NO. 6 - PLAIN LAP
No.20 Gauge and Lighter
NO. 7 - STRAPPED BUTT JOINT
Soldered only. No. 22 Gauge and Lighter. Riveted and Soldered Any Gauge
NO. 8 - RIVETED LAP
Any Gauge
NO. 9 - O-GEED
Riveted Lap any Gauge
NO. 10 - PLAIN LOCK
No.18 Gauge and Lighter
NO. 11 - FLUSH LOCKED SEAM
No.18 Gauge and Lighter
NO. 12 - FLANGED RIVETED
Any Gauge
NO. 13 - KEYED LOCK
No.16 Gauge and Lighter
NO. 14 - SIDE LOCKED SEAM
No.18 Gauge and Lighter
NO. 15 - STANDING END LOCK
No.16 Gauge and Lighter
NO. 16 - FOLDED END LOCK
No.18 Gauge and Lighter
NO. 17 - INSIDE LOCK
Wood Tank Lining
No.18 Gauge and Lighter
Round-Head Screw
Lock-Seamed Joint
Sheet Lining
NO. 18 - LOCK SEAM
No.18 Gauge and Lighter
Wood

Fig. 2—Mechanical joints and edge reinforcements used for Monel, nickel and Inconel sheet. The majority of the joints are usually soft soldered.

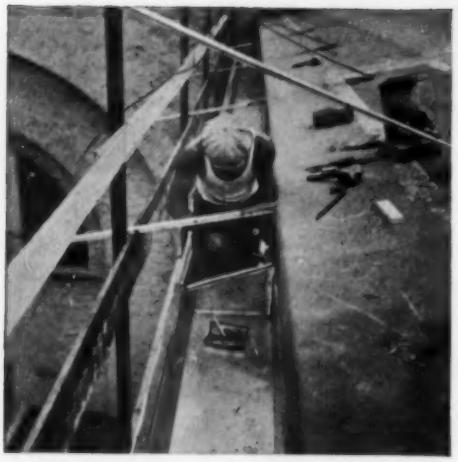
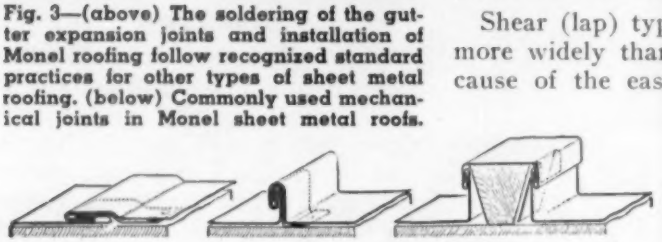


Fig. 3—(above) The soldering of the gutter expansion joints and installation of Monel roofing follow recognized standard practices for other types of sheet metal roofing. (below) Commonly used mechanical joints in Monel sheet metal roofs.



Joints, 18 in. long, made by an experienced mechanic, following good shop practice, were sheared into 1 in. and 2 in. wide tensile specimens, then pulled in a universal testing machine. Failure of the lap seams occurred by rupture in tension of the parent metal, and in some cases by rupture in shear of the soldered joint. Lock seamed joints all failed by tearing of the solder fillet.

Surfaces of metal parts to be soft soldered must be clean and free of any surface oxide or other discoloration. Foreign material, such as oil, must be removed. Oxide or other tarnish can be removed mechanically with emery cloth or by light grinding, or chemically by pickling. Wherever possible, the surfaces to be joined should be "pretinned" to insure complete bonding during the final soldering or "sweating in" operation. "Pretinning" is done with the solder to be used for the joint and not necessarily with pure tin as the term would seem to indicate. With untinned edges the solder may not penetrate throughout the joint.

The heat necessary for the soldering operation is supplied by a soldering "iron" (really a soldering copper), city gas-air torch, air-acetylene torch, or oxy-acetylene torch. Because the transfer of heat through the high nickel materials is slower than through copper, it is necessary to use either a hotter or a slightly larger soldering copper than that regularly used for similar jobs in copper.

Silver Brazing

Silver brazing is the term chosen recently to replace the older names, "silver soldering," and "hard soldering." It is defined as "a brazing process wherein a silver alloy is used as a filler metal." The strength and the corrosion resistance are greater for properly designed and executed silver brazed joints than for soft soldered joints.

Shear (lap) type joints are used more widely than butt joints, because of the ease of maintaining better fits with the former and the facility whereby adequate strength can be obtained merely by extending the lap shear area. Butt joints can be used, but require very careful alignment of parts to obtain uniform clearances. Some examples of brazed lap joints are: cross wire silver brazing; corner joints in thin containers of folded sheet metal, as in photographic trays; the attachment of spuds to tanks; and joining tubes to fittings and to tube sheets. Typical joints used in silver brazing are shown in Fig. 4.

The strength of a properly made silver brazed joint should be approximately 50,000 psi. in tension and 30,000 psi. in shear, at room temperature. These values are used in design calculations with a factor of safety of 5. The maximum temperature to which silver brazed joints can be expected to carry an appreciable load is 600 deg. F. and at that temperature their tensile strength is only about 50% of that at room temperature.

In shear (lap) joints, drive fits should be avoided. Clearances of .002 in. to .005 in. (preferably .002 in. to .003 in.) that will permit the molten silver alloy to be drawn

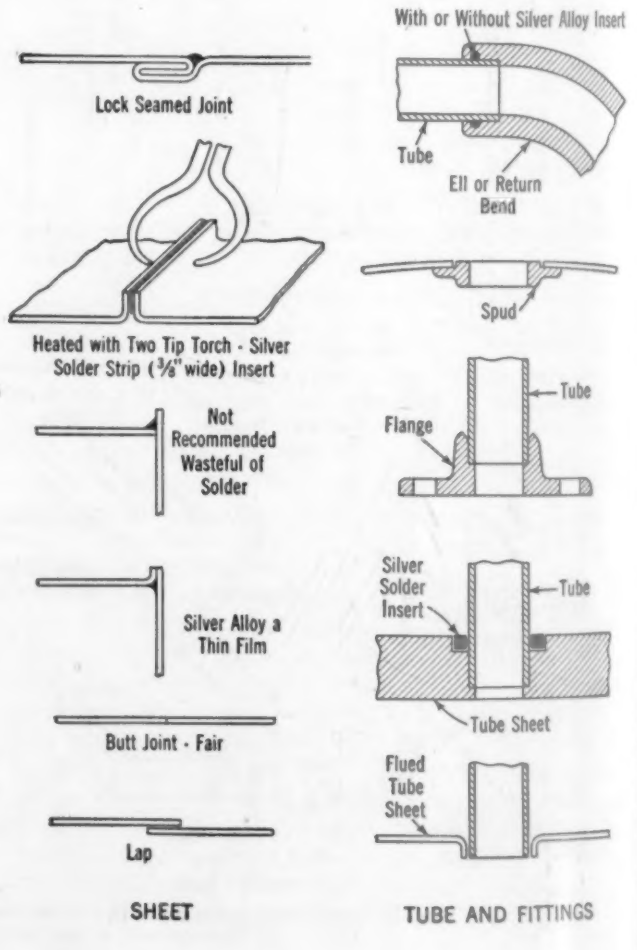


Fig. 4—Typical joints used for silver brazing.

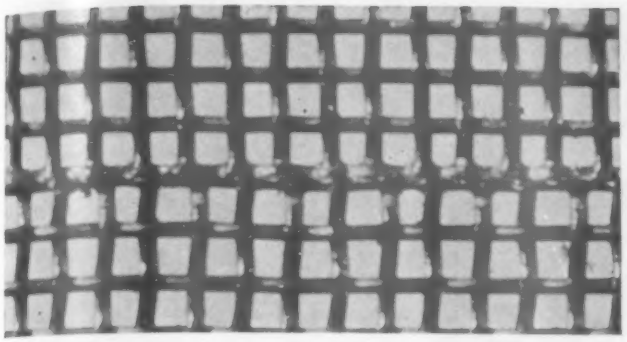


Fig. 6—A magnified view (20×) of a silver brazed seam in 45-mesh Monel cloth.

through by capillary attraction, are recommended. Excessive clearances of .006 in. to .015 in. should be avoided. Not only are such joints wasteful of silver brazing alloy, but also they are lower in strength than those that have been made with proper clearances. In pipe fittings, grooves or reservoirs are provided, as shown in Fig. 4.

Brazing Alloy and Flux

Silver brazing alloys of low melting point are best for joining high nickel materials. These are essential for Monel, which is subject to intergranular attack by molten brazing alloys and failure if under even low stress at temperatures of 1400 deg. F. or higher. Monel is not subject to attack when temperatures below 1400 deg. F. are maintained during brazing operations.

Preferable compositions are those melting at less than 1200 deg. F.; for example Handy & Harman's "Easy-Flo" (50% silver, 15.5% copper, 16.5% zinc, 18% cadmium) melts at 1160 deg. F. and flows at 1175 deg. F. The same producer's less frequently used Grade RT composition (60% silver, 25% copper, 15% zinc), which melts at 1260 deg. F. and flows at 1325 deg. F. fulfills the requirements of special cases calling for the higher silver content. "Handy Flux" is used with both brazing alloys. Borax and boric acid fluxes are not useful for silver brazing, because they are not fluid at the temperature levels recommended and hence are not protective.

Wires of various diameters are used for hand feeding. Thin sheet or strip cut to shape may be used for preplacing the brazing alloy in some forms of joint. As a guide, one ounce of $\frac{1}{16}$ in. diameter brazing alloy is required to braze a 5½ ft. long tightly fitted flush lock seamed joint. For lap joints less alloy is required because of closer fits, but of course, exact conditions must be known to determine the quantity required.

"Sil-Fos," although it is an excellent brazing material for brass and copper, is not recommended for use on Monel, nickel or Inconel because of an embrittling effect of the phosphorus constituent. Phosphor-copper, which contains no silver, is ruled out for the same reason.

Brazing Procedures

All foreign material must be removed from the parts before assembly. The dark colored oxide layer resulting from heating, as in annealing, must be removed either mechanically, with emery cloth or by light, fine grinding, or chemically by pickling.

Flux is applied usually by brushing a thin film in paste form over the surfaces to be joined. The flux prevents oxidation during heating, dissolves oxides formed during brazing, and assists in flowing out the brazing alloy.

The usual methods of heating the parts to be silver brazed are, (1) by a manually manipulated gas flame, such as oxy-acetylene or oxy-city gas, (2) in an electric furnace, (3) by incandescent carbon, (4) by electric induction, and (5) by chemical (salt) bath. In gas brazing a neutral or slightly reducing flame is used, and the parts are heated thoroughly to flow out the brazing alloy.

If it is desired to restrict the area to be wetted by the brazing alloy, a stop-off paste may be used. A thick paste of graphite and sodium silicate serves the purpose and is easily removed after the brazing operation is completed.

Since the temperatures required for joining with silver brazing alloys are well below those for annealing Monel, nickel and Inconel, the softening effect of brazing is very slight. Heat treated "K" Monel or "Z" nickel parts are silver brazed with only a slight local softening. Heat treatment of "K" Monel or "Z" Nickel may also be carried out after silver brazing.

Oxy-Acetylene Welding

Both oxy-acetylene and electric arc welding produce satisfactory joints in Monel, nickel and Inconel and the choice of method is determined, not by the metal but by the physical characteristics of the piece to be welded, namely, gauge of metal, design of the piece and design of the individual joint.

The oxy-acetylene welding process has been used quite satisfactorily for about 20 years with Monel and nickel and for about 10 years with Inconel. The process is being applied to the fabrication of all types of equipment in the many fields in which these materials are used. Good welding is accomplished with it in flat, vertical or overhead positions.

Corner welds and lap joints may be used where high stresses are not to be encountered. In such equipment as pressure vessels, butt joints are preferred for gas welding, since stresses act axially, rather than eccentrically.

For butt joints in material of .050 in. to $\frac{5}{32}$ in. thickness, beveling is not required. For vee joints in thicker metal, the sheet and plate edges should be beveled to an angle of 37½ deg. on each side.

For sheet .043 in. and lighter, both butt and corner edge welds are used. Corner welds can be made by oxy-acetylene welding in gauges of .037 in. and thicker. Tube joints are made preferably by oxy-acetylene welding, since a great deal of position welding of thin walled (.049 in. to .125 in.) and small diameter (½ in. to 4 in.) tubing is involved.

The tensile properties of oxy-acetylene welded joints in Table 3 are used in the design of gas welded equipment.

Table 3—Tensile Properties of Oxy-Acetylene Welded Joints

Metal	Tensile Strength
Monel	65,000 psi. (minimum)
Nickel	60,000 psi. (minimum)
Inconel	75,000 psi. (minimum)

(To be continued next month)

Brief Sketches of Welding Jobs

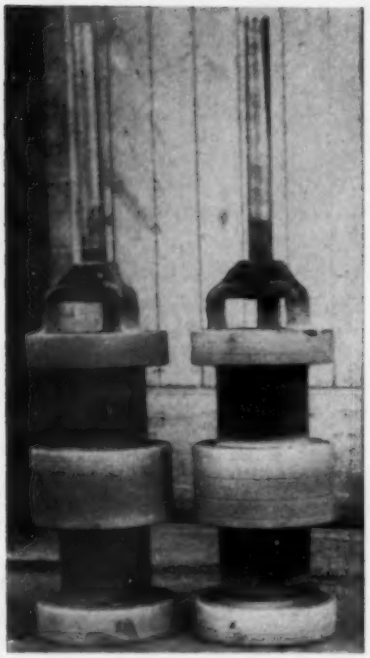


Fig. 1—Piston valves built up about ⅛ in. with mild steel.

Metal Spraying Applications

By H. V. KAEPPEL

★ Figure 1 shows two piston valves of a twin engine for a saw mill carriage drive. These valves are 7 in. in diameter, cast-iron, and were built up with ordinary cold rolled steel to fit rebored valve chambers. Special emphasis was placed upon the edges which had to finish up clean and sharp in order not to interfere with the cut-off periods. The thickness of applied coating was approximately ⅛ in. A total of 14 lbs. of steel was required for the two valves.

Figure 2 shows clutch and reverse gear of a marine Diesel engine, the friction cones having been built up with bronze 1/16 in. thick. The base metal is cast-iron.

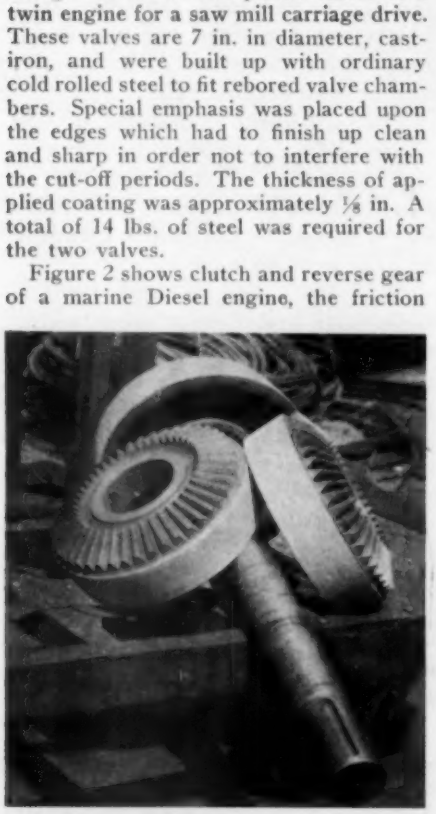


Fig. 2—Friction cones of these gears were built up 1/16 in. with bronze. Base metal is cast-iron.

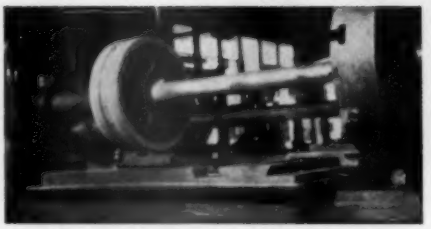


Fig. 3—Air compressor piston (12 in. dia.) built up nearly ¼ in. to fit a rebored cylinder.

Fig. 4—Propellor blade being sprayed with bronze to restore true surface.

Figure 3 is a cast-iron air compressor piston 12 in. in diameter which was built up nearly ¼ in. to fit a rebored cylinder.

Figure 4 illustrates the method of building up propellor blades of a west coast freighter. After a certain length of time in use these propellor blades begin to show signs of pitting. The procedure is simple, the propellor blades being sand-blasted to obtain a clean surface, then sprayed with bronze to build up the entire blade to a true surface. In spraying, temperature of the propellor need not be increased over 50 deg. F., obviating the possibility of warpage or distortion. The cost of reclaiming these blades by spraying does not exceed $50, as compared with several hundred dollars required to purchase a new propellor.

Figure 5 shows a perforated drum used as a centrifugal dryer in laundries and cleaning and dyeing establishments. It is made of copper which is subject to corrosion by solutions used in cleaning and dyeing. This introduces the danger of discoloring clothes. In order to counteract this possibility these dryers are metal sprayed on all surfaces, outside and inside, with Monel metal. After spraying the inside surface is usually polished with emery cloth to prevent damage to fine silks.

The Metalspray Co. of Los Angeles, Calif., has been doing this job successfully for several years. The Monel metal is applied in thickness of approximately .0001 in. The job contract on these is $26 for spraying, which is only a fraction of the cost of such dryers if they are made of Monel throughout.

» «

Micarta Application in Hydromatic Welding

By J. E. CALLAHAN*

★ Pitting and freezing of pistons controlling spot welders has been eliminated by an ingenious application of laminated plastics. Two large hydromatic welders used for spot-welding automobile frames on a production basis developed trouble through the freezing of the many pistons controlling the welds. Investigation dis-

* Westinghouse Electric & Mfg. Co., Philadelphia, Pa.

Fig. 5 — Spraying Monel metal on all surfaces of a copper drum used as a centrifugal dryer.

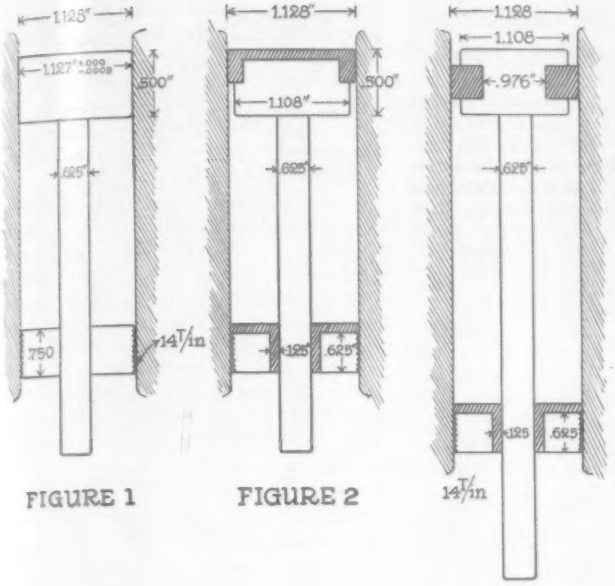


FIGURE 1 FIGURE 2

FIGURE 3

How Micarta was used to insulate pistons of a huge hydromatic welding machine. This reduced wear caused by arcing of induced currents.

closed that due to the heavy electric currents employed, the entire machines had become magnetized.

With every stroke of the pistons through the lines of magnetic force, an electric current was generated, resulting in arcing between pistons and cylinder walls and between pistons and guide bushings. Not only did such a condition result in serious pitting of the parts affected, but in a short time the pistons became tightly welded to the cylinder walls and guide bushings. Figure 1 illustrates this condition.

With the object of breaking the magnetic fields created in the machines and eliminating possibility of arcing between pistons and cylinder walls, sleeves machined from Micarta rod were placed over the pistons. Although the original guide bushings were made of brass, a non-magnetic material, it was found necessary to protect them with a Micarta sleeve in order to afford definite electrical insulation with minimum material and machining costs.

The application is shown in Fig. 2. As a further safeguard toward minimizing the magnetic field all bolts, nuts, and other parts were insulated with Micarta tubing, washers and gaskets. While Micarta was admirably suited for insulation between the piston and cylinder walls, as can be seen from Fig. 2, it did not provide an adequate oil and air seal for the pistons.

As proven by many applications, Micarta has demonstrated its wear-resisting qualities for piston ring fabrication. Despite the highly accurate machining required and the extremely close tolerances demanded by this installation, suitable Micarta rings were designed. Fabricated from a grade of Micarta plate that provides a 90 deg. action between the layers of the laminated material and the cylinder walls, such rings on other applications have given from two to five times the length of service afforded by other materials.

In order to provide sufficient "spring" to the rings to afford the desired oil and air-sealing characteristics required, and to allow being sprung over the pistons, they were machine to an O.D. of 1.139 in. and bored to .993 in. Slotted on a milling machine using a 1/32 in. cutter at an angle of 45 deg., the resulting ring, when closed, produced a perfect circle 1.128 in. O.D. and .976 in. I.D. All of the 1,375 rings were furnished .250 in. face width and because of the accurate control required in making the welds a tolerance of plus or minus .001 in. had to be maintained on all sizes.

» «

Welded Grille Protects Stock and Children

By M. T. PATE

★ Utilizing material from its scrap bin, one crude oil producer called on the welder to provide a guard for the knock-off or connecting mechanism used to connect one well to the central power unit.

Supported on a pair of extended rods at each end, and two more at the middle, the long grille of half-inch sucker rod completely covers all but the bare rod line, and effectively fends off stock which may be grazing in the field in which the equipment is located. Access to the equipment is afforded by resting the supports in pipe sockets, buried in the ground, so that the entire guard can be removed simply by raising vertically until it clears the rod line.

Use of the shield also effectively discourages children in the neighborhood from attempting to steal "rides" by balancing on the reciprocating equipment.

This welded grille of ½ in. sucker rod protects pumping unit.

» «

Welded plank brackets placed at working level below pipeline. They expedite maintenance work.

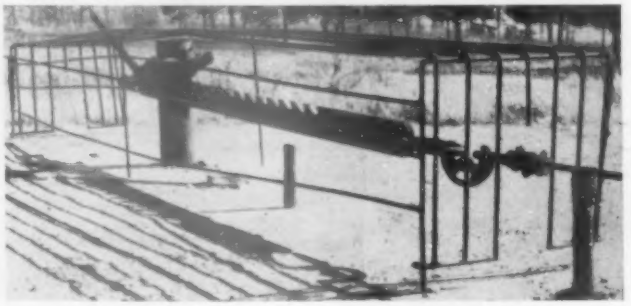
Welded Brackets Simplify Pipeline Maintenance

By M. T. PATE

★ Maintaining the hydraulic gradient across an arroyo occasionally swept by scouring floods, a cast-iron pipe line is carried on graduated pipe A-frames, anchored to buried concrete bases. These welded A-frames were built to dimension, so that when erected the line would extend in unbroken grade from one bank to the other.

To permit inspection, painting, caulking and other maintenance work on this

(*Continued on Page 38*)



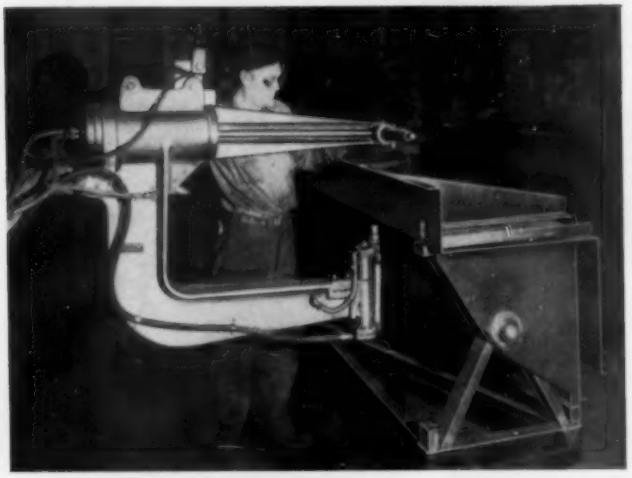


Fig. 1—Support bracket for upper electrode is so designed that the electrode can be swiveled to a horizontal position as shown. This provides greater channel clearance.

Novel Type Spot Welding Guns Used on Steel Dump Bodies

★ Standard dump bodies are now being assembled by spot welding at the truck plant of the Gar Wood Co. in Detroit, Mich., as the result of development of special deep-throated swivel-electrode guns of high capacity. The development has permitted extensive use of formed steel gusset and reinforcing plates in standard bodies insuring high body strength, without use of heavy structural shapes.

Employing a total of four heavy-duty spot welding guns, designed and built by Progressive Welder Co., 737 Piquette Ave., Detroit, the assembly is progressive in character. Steel is generally of 10 gauge and comes to the welding department on a portable, tilting-top carrier, which accommodates either a right or left-hand floor section, one side of which forms one body side, the opposite side being formed into channel shape.

The first gun in the production line is used, first, to weld outriggers to right and left-hand floor sections. In order to permit the welding electrodes to clear the channel (Fig. 1) the support bracket for the upper electrode is carried in the gun frame in such a manner that the electrode, by means of a self-locking lever manipulated by the operator, can be swiveled to a horizontal position. When the upper electrode has cleared the channel, the electrode is turned back to welding position (vertical).

The gun is then removed and the work tilted to bring the body side into horizontal position for welding the braces to the body sides. This sequence of operations is then repeated for the opposite body and floor side. The same gun is now used for welding cross members to center floor section (longitudinals), the swivel feature of the gun again permitting the gun to clear the depth of both left and right-hand channels which are formed out of the floor center.

The flexibility and clearance of this special gun is due largely to the use of sliding internal electrical contacts in the gun proper, greatly simplifying the design and permitting incorporation of rigidity in the gun frame. Right and left-hand floor sections are next assembled in a jig with the center section—the channels formed out of the center section of the floor nesting into the channels of each right and left-hand floor section.

A pincher type gun welds the gusset plates previously tacked to cross members by arc welding to the cross members themselves and to the longitudinals. It also welds the entire length of the two channel sections (forming the longitudinals). Work is then moved to No. 3 gun, which is of the pincher type designed for horizontal welding. This gun is used for welding the top surface of the longitudinals together as well as the running boards to the outriggers.

Work is then completely inverted to bring the body right side up, and is moved to gun No. 4 (Fig. 2). This gun, of sliding contact type, similar in principle to the gun at the beginning of the line, has two interesting features: (1) It is so designed as to permit the jaws to be swung open to admit exceptionally deep work and then closed and locked for welding (used on special body types); (2) the gun is suspended on a bowed support which tilts the gun away from the vertical, permitting spots to be made at close quarters. This gun is used (on standard bodies) for welding the front of the body to the body sides and joining back braces (tacked in position by arc welding) to the body sides, marking the completion of the spot welding operations.

All spot welding operations are controlled through Weltronic timers, which permit accurate and automatic regulation of "current on" and "current off" time, while electrodes are in contact with the work. The timers are of the auto-interrupting type to permit use of several "shots" of current during welding of a spot. As a result, close control of welding characteristics is obtained and overheating and burning prevented. Arcing is eliminated by use of high welding pressures secured by means of Progressive air-hydraulic boosters.

Fig. 2 — This gun has jaws which can be swung open to admit deep work and then closed and locked for welding.

» «

Suppressing a Noise Nuisance

By M. T. PATE

★ The intermittent "bark" from the exhaust of a single-cylinder gas engine powering a small plant, around which a small community had grown up, proved to be a decided nuisance.

Rather than incur the expense of installing some type of muffler which would deaden the noise to a satisfactory degree—with possible loss of power through the more intricate muffler required—the operator called in a welder and put the problem up to him. The solution he suggested necessitated simply a slight remodeling of the original muffler, by welding pipe sections together as shown. Perforations in the inner pipe permit the gases to reach the space between,

Simple noise suppressor built by welder to quench the annoying blast from a single-cylinder engine exhaust.

and then to flow through the short, beveled end stub.

The beveled end was notched with a torch, leaving a series of half-inch high projections separated by cut-away portions of the same depth. To these projections was welded a shaped "hat" of tank plate, cut elliptical to provide approximately equal projection over the apertures thus created. The top of the cover plate was bent approximately flat, and this further cut down the flow of gases from the highest point.

Upon installation of the plate, the intermittent exhaust was throttled sufficiently to effect satisfactory muffling, even to dwellers in the nearest house, within 20 ft. of the power unit.

» «

Welded Steel Bridge Railings

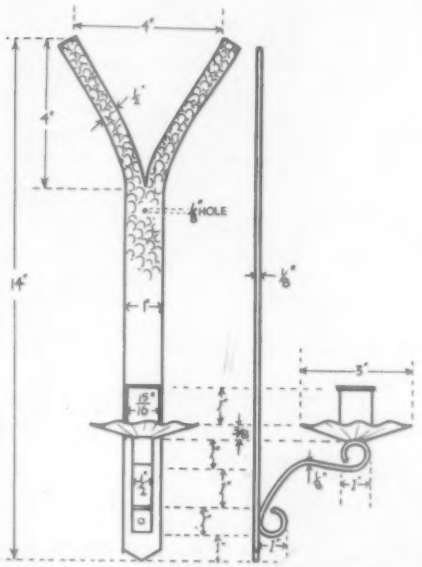
★ Park Iron Works Co., Cleveland, Ohio, were the fabricators of these rugged 5-ft. high steel railings installed on Cleveland's new East 9th Street Bridge. The two 195-ft. lengths were made of a welded design which utilized only steel plate, pipe and channels. Total weight of railings is about 28 tons.

All-Welded Ornamental Wall-Type Candle Holder

By ARTHUR HAVENS

★ This decorative candle holder will be a welcome job for some welder or amateur craftsman. I have a couple in my dining room and I know that practically everyone notices them.

The first requisite is a piece of ⅛ in. band iron of the necessary length. This is then peened lightly with a ball-peen hammer and later polished with a piece of emery cloth to give an antique finish. Next step is to cut a piece 14 in. long and split one end with a hammer and chisel for a distance of 4 in. These parts are then spread apart about 4 in. One inch up from the bottom, a ⅜-in. hole is drilled. The curved bottom of the candle holder, is made from ⅛ in. by ½ in. strip rolled up at each end into a 1 in. circle and curved as shown in the sketch.



Decorative wall-type candle holder.

Next cut a circle from 20 gauge black iron about 3 in. diameter. This piece must be corrugated; one way to do this is to clamp two pieces of ⅜ in. round to the bench, ⅜ in. apart and then lay the disc on them, placing another piece of ⅜ in. round on top of the disc and between the other two located underneath. Then strike with a hammer and if this is carried out carefully around the entire disc an even corrugation will result. Next take a small piece of 20 gauge (1⅛ in. by 3¼ in.) and roll it into a tube and weld it for the candle holder.

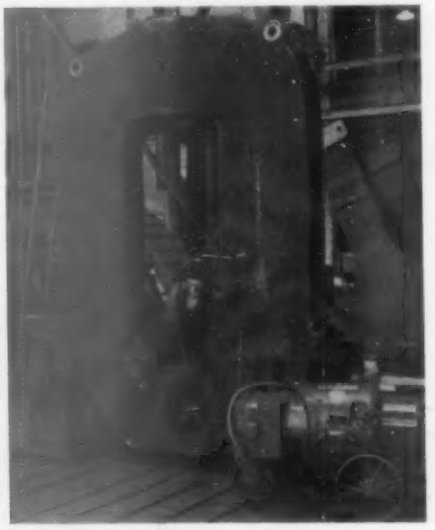
For the flange simply peen the edge of the tube over with a hammer. Drill three ⅛-in. holes equidistant around a circle drawn on the corrugated disc. Set the candle tube upside down on the bench and place the disc over it. Then tack weld the two parts together through the holes. The holder is tack welded to the curved part in a similar manner. Next set up the whole assembly in position and tack weld the lower curved part to the main bracket through the ⅜-in. hole drilled previously. The thimble and disc can be painted black.

» «

Sheet Mill Roll Frame Rebuilt Quickly by Arc Welding

★ When a large steel plant found that its sheet-mill roll frame was badly worn, it was repaired quickly by arc welding. The real problem was to get it done without stopping production of vital materials. Consequently the job was done during a week-end holiday. When dismantled, the 41,000-lb. cast-steel housing was delivered to the machine shop of the Canadian Westinghouse Co. Building up the surface to permit both the feet and bearing recess to be machined to original contours and size required 405 cu. in. of weld metal weighing 115 lbs. This was obtained from 160 lbs. of ¼-in. down-hand welding electrodes, thus showing an overall deposit efficiency of 72% of electrodes used. Welding was continued by means of relief operators, without a moment's interruption, except for two changes of position, until the job was completed and ready for the machine shop.

Welded bridge railing used only steel plate, pipe and channels. Photo (Wilson Welder & Metals Co.).



Frame set up ready for arc welding. Photo (Westinghouse Electric & Mfg. Co.).

Welding Aids The Tuna Fishing Industry

By W. E. ARCHER

★ Welding has contributed to a marked degree in the development of one of Southern California's major industries—tuna fishing. This development has been through improved facilities, and in safer, more efficient and longer lasting equipment. Through welding, improved equipment with added fuel carrying capacity makes possible longer cruises, and by utilizing practically all available space within the boats, added storage capacity for catches is provided. Also, improved refrigeration assures preservation of the fish until the cruise is ended. All of these features make for increased profits for the many fishing interests which operate from San Pedro and San Diego to the fishing banks of Lower California, Mexico and Central America.

The boats used in this work range in length up to 150 feet, and have capacities from 50 to 400 tons of fish. The largest boats are driven by 600 hp. Diesel engines, with two auxiliary 90 hp. motors.

The illustrations show fuel tanks under construction at the shipyards and dry docks of the Campbell Machine Works in San Diego, Calif. It will be noted how the shapes of the tanks are made to conform to the contour of the hull, thus utilizing as much as possible all available space within the craft. In fabricating these fuel tanks, all joints are butt welded inside and out. The thickness of the steel plate used depends largely upon size of the tank and its location within the craft, the heaviest material being ¼-in.

When practical, tack welding is first used in the assembly of the tanks, and on all long seams, the step-back method of welding is employed in order to minimize contraction and expansion. On all ¼-in. and 3/16 in. plate, one bead or pass on each side has usually been found sufficient; however, in some cases two beads have been found essential. These are usually determined upon inspection of the welds, or where it is believed that the area will be under high stress.

On the tanks used in the bow and stern, where vibration is most severe, ¼x2-in. butt straps are added. In those tanks ¼-in. plate is used. Splash, or baffle, plates of 3/16-in. plate are welded inside the tanks at 3-ft. intervals, same being reinforced at the corners and at 2-in. intervals with welded angle-iron clips.

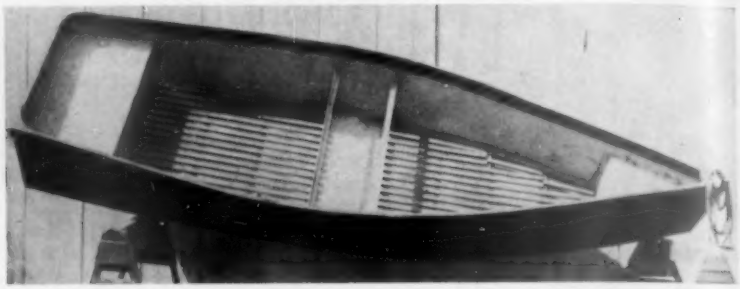
The brine wells are of ¼-in. plate, also with butt-welded joints. These are reinforced outside with 4-in. I-beams at intervals of 18 in. on the "roundabout," and at intervals of 22 in. on the faces. One of these brine wells is shown in Fig. 1.

Practically all of the piping on these boats is welded. This is an important phase of the boat's construction, considering the great amount of piping required in the brine-circulating systems, ammonia lines, ventilation facilities, etc. On account of limited space in the hull, difficulties in pipe fitting are many. This calls for extended use of the cutting torch. All of the piping within the large refrigerated brine tanks is arc welded, but the vast amount of ammonia and air piping is usually welded by the oxy-acetylene torch.

According to William Kairot, welding supervisor for Campbell Machine Works, very little material indeed goes into modern fishing craft of this type, which has not in one form or another been welded or formed with the aid of a cutting torch.

Fig. 1 — Assembly of tanks as used on these boats for tuna fishing. Upper left corner shows one of the salt brine "wells."

Fig. 2—Note how the shape of a fuel tank is made to conform to the hull contour, thus utilizing all available space. Splash or baffle plates (3/16 in. thick) are welded in at 3 ft. intervals.



This all-welded steel boat of 20 gauge sheet steel saved the owner (and builder) about 1/3 the cost of a ready-made boat.

Attention Anglers! An All-Welded Boat

By CHESTER L. WRIGHT

★ Shown here is an all-welded boat built of 20 gauge steel sheet. George Gilland, owner of this boat, claims that he made a saving of ⅓ the cost of a comparable boat purchased ready made. In fabricating this row boat, Mr. Gilland cut the bottom section in one piece. Each of the side pieces and the stern end piece were formed with a 3/16 in. flange turned outward on the bottom edge. In assembling the boat, these flanges were rested on the bottom piece and an edge weld was made all the way around the bottom of the boat. He succeeded in doing this so neatly, that there is very little evidence of welding in the finished boat.

(*Continued from Page 35*)

pipe line, individual scaffold brackets were welded on as part of each A-frame, being set three feet below the pipe saddle so as to hold the removable boards at a safe working height. The boards spanning gaps between frames were removed or placed by the maintenance crews, and a marked saving effected over leaving the timber in place.

As a safety member, the brackets, instead of being welded so as to lie flat or horizontal when erected, were inclined toward the pipe at a slight angle, so as to hold the scaffold planks securely and prevent them slipping.

With two long boards, and the necessary maintenance tools, two or three men can work the entire crossing without descending to ground level.

New Product Developments

A-C. Hard-Facing Rod

★ **Stoody Co.**, Whittier, Calif., manufacturers of hard-facing rods, announce the development of Stoody A-C., a new hard-facing alloy. Stoody A-C., as its name indicates, was designed especially for application by alternating current welding machines. This new electrode flows freely under the arc, produces very little spatter and forms a hard, tough, wear-resistant deposit.

According to the manufacturers, Stoody A-C. is suitable for all types of applications requiring an A-C. hard-facing electrode. It is available in three rod sizes: 1/8 x 14 in., 5/32 x 14 in. and 7/32 x 14 in.

» «

Continuous A-C. Arc Welder

★ Ergolyte Welders, made by the **Ergolyte Manufacturing Co.** of 3644 Lawrence St., Philadelphia, Pa., offer new convenience in welding. All controls and sockets have been brought into full view on a sloped panel, eliminating necessity for crouching or squatting to select heats or make adjustments. Heats may be selected in gradual steps over a wide range, correctly proportioned to correspond to the commercial gauges of metal handled. Insulation is double-spun glass.

Ergolyte welders employ a broken-wave current produced by a special winding which, it is claimed, makes them stable and quiet in operation, regardless of how unsteadily the electrode is held. Thus, smooth uniform beads and fillets, free from undercutting and piling up are possible, and with low spatter loss.

The current required at no load never exceeds 50 watts, it is claimed. Two models are available, No. 160 with a current range of 15-160 amp. and No. 250 with a current range of 15-250 amp. Ergolyte welders operate on single-phase. Machines are guaranteed for one year and are furnished complete with accessories — helmet, rubber-covered cables, electrode holder and assorted sizes of electrodes.

Ergolyte a-c. welder offers operator convenience in selecting proper heats.

» «

New Westinghouse a-c. welder

New A-C. Flex-Arc Welder

★ A new modern all-purpose portable a-c. welder designed for all-around general utility service and production welding of every type, has just been announced by **Westinghouse Electric & Mfg. Co.** Standard models operate on either 220 or 440 volts, are completely self-contained, and incorporate several distinct new design features.

From 20 to 250 amp. of welding current is available in 27 current steps, with increments properly proportioned to meet the needs of welding with a wide variety of electrode types and diameters. Current adjustment is easy; merely select the current desired, insert the bayonet plugs in the proper receptacles and the machine is ready to weld. Current values are clearly indicated in large legible numerals.

Safety is well provided for. A built-in "De-Ion" breaker insures protection against long sustained overloads, such as might occur by accidentally leaving the machine short circuited. This is convenient, too, for disconnecting the machine from the line without having to go back to a service or feeder switch. Open circuit or striking voltage is exceptionally low, being on the order of 80 volts at 20 amp., and ranging down to 50 volts at the highest current rating.

The welder is completely self-contained, being enclosed in a rugged steel case which is mounted on three wheels. Thus the machine is portable too. High efficiency, high power factor, and low no-load losses insure maximum operating economies. The welder is furnished complete with all accessories, including welding helmet with lens, electrode holder, all leads, and a 17-lb. assortment of electrodes. Both a three-pronged plug and receptacle for the power lead is included.

For further information write to department 7-N-20, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

» «

Sponge Type Sweat Band

★ Two new, ruggedly constructed sweat bands, made of fine pore, cellulose sponge securely stitched to a fabricoid band with an inner lining of cork, are announced by **Jackson Electrode Holder Co.**, Detroit, Mich.

No. 15, photographed in position, is a general-purpose band for eliminating the hazard of perspiration running into the eyes. It is easily adjusted to the head with a long-lasting, ½ in. wide, elastic band.

(Above) No. 15 general purpose band. (Below) No. 5 band for fastening to Jackson eyeshields.

No. 5, illustrated in the drawing, is intended for use with all Jackson Eyeshields, except Types D, D-6 and No. 25. It is easily snapped inside the bands.

Both bands are light, cool, comfortable—easily absorb more than 15 times their weight in moisture. Sanitary, both are quickly cleaned by letting water or any safe, antiseptic solution run through the sponge cellulose.

NOW IS THE TIME TO JOIN THE
American Welding Society
33 West 39th Street
New York City

Acme Type 1 foot-operated spot welder.

Acme "Hot Spot" Welder

★ **The Acme Electric Welder Co.** of Huntington Park, Calif., announces an improved line of foot-operated rocker arm type spot welders with all-welded fabricated steel bases and incorporating a great many innovations and distinctive features.

The Type 0 with stationary lower horn holder and the Type 1 with swivel lower horn holder are manufactured in 10, 15 and 20 kva. capacities and in throat lengths of from 12 to 36 in., complete with water-cooling equipment.

A clamping block device retains the horns in the horn holders with ideal electrical contact, yet a half-turn of a ⅝ in. diameter set screw instantly releases for change of setup.

Horns are universal double end reversible, one end machined to hold electrodes at 90 deg. angle and opposite end at 22½ deg. angle.

Complete details of Type 0 and Type 1 spot welders are described in Bulletin No. 50 which will be sent on request. Other spot welders in the line include foot-operated machines up to 75 kva. and automatic air-operated production machines up to 500 kva.

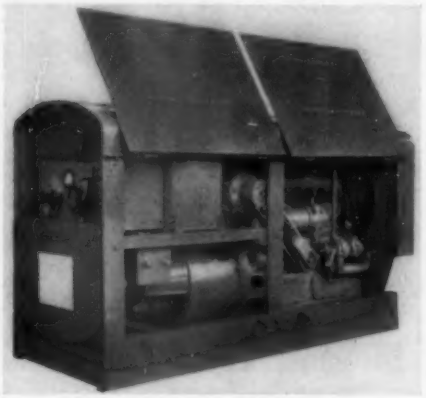
» «

400-Amp. Lincoln Diesel Arc Welder

★ The application of gasoline engine starting on diesel-driven arc welders, announced previously on a 300-amp. unit by **The Lincoln Electric Co.**, Cleveland, Ohio, has been further extended and is now available on a 400-amp. model. This advance makes available easy starting in any weather and the inherent economies of diesel drive in the many applications for engine-driven welders of capacities up to 400 amp.

According to field reports, the diesel welder cuts fuel costs 33% to 86%. Total savings run as high as 40 cents per hour. Fuel oil consumption is 1.5 gallons per hour at full-load operation, compared with 2.75 gallons of gasoline with conventional engine-driven welders. In addition to its operating economy, the diesel engine compares favorably with gasoline engines in simplicity, weight and cost, as well as operating speed.

The gasoline starting engine is a small auxiliary mounted above the diesel. It is started by means of a hand crank. A belt drive, engaged by means of a clutch, connects the starting engine to the diesel. Starting in extremely cold weather is facilitated by having the cooling system of the small starting engine connected into the cooling system of the diesel. This permits warming up the diesel by running the starting engine a short time and allowing the heated water to circulate through the diesel engine.



400-amp. Lincoln diesel engine-driven arc welder.

Of 400-amp. capacity, the "Shield Arc SAE" arc welding generator used on the new diesel welder is equipped with "dual continuous control" and all of the other Lincoln features.

A substantial channel frame provides mounting for the entire unit. The frame of the arc welding generator is attached directly to the diesel engine bell housing. A special type of flexible coupling connects the generator shaft to the engine flywheel.

The price of the new diesel engine-driven welder, equipped with gasoline engine starting, compares favorably with conventional gasoline engine-driven arc welding sets.

» «

A Vanishing Cream For Welders and Cutters

★ Ply No. 8 is a recent development in industrial skin protection by the **Milburn Co.**, 905 Henry St., Detroit, Mich. This new product is for welders and cutters, especially at times when large diameter rods are required. In such operations flashes occur, which may cause burns of a severe nature due to the ultra violet and infra-red rays, which can penetrate several layers of clothing. On the other hand if Ply No. 8 is used, welders and cutters can work with their shirts open at the chest and scantily clad (for comfort during hot weather) without danger of burning.

Ply No. 8 is manufactured upon a background of biochemical and medical research. It is applied like a vanishing cream, rubbing into the skin completely dry and practically invisible. Its ingredients screen the heat rays and prevent excessive burning. In a similar manner it will prevent burn from the direct rays of the sun. Packaged in 6-oz. glass jars, 12 jars to the carton.

» «

Portable Butt Welder With Burr Grinder

★ The **Eisler Engineering Co.** of 740-770 South 13th St., Newark, N. J., has developed a portable butt welder with a burr grinder and annealer mounted on a fabricated case which is portable. One of its many applications is in the repair of stranded wire, where this unit is used to burn out (electrically) the faulty section and fuse all the strands, thereby preventing the ends from unraveling.

The final steps are to butt weld the two ends, and grind off any burrs that may develop. The grinder has an accurate adjustment to compensate for wear in the abrasive and there are two special bushings to guide the stranded wire to the grinder which squares off the ends so as to make neater butt welds.

The butt welder is supplied with a 3-kva. air-cooled transformer and 8-point variable switch for current regulation. The unit is foot operated and the butt jaws can be water-cooled for continuous service. Metals from 1/16 to ⅛ in. diameter can be welded. For butt welding other sizes of wire or metals, units are available with transformers from 1 kva. up to 7½ kva. capacity.

» «

Eisler portable butt welder.

All failed in the parent metal

NOT ONE FAILED IN THE WELD

Laboratory inspected cast-iron bars were cut in two, the edges beveled, then welded together with Tobin Bronze... and subjected to straight pull strength tests. All failed in the cast iron... there were no failures in the Bronze! Tobin Bronze* is uniformly dependable—welders like the way it flows, and the tough, strong, durable bonds it produces.

The uniformity of Tobin Bronze is the result of expert metallurgy, close inspection and accurate laboratory control. That's why you can always count on Tobin Bronze.

There are 18 Anaconda Welding Rods ...each suitable for a special purpose. Their characteristics as well as welding procedures are outlined in detail in Anaconda Publication B-13. A copy will be mailed to you — without cost — for the asking.

40122

• • •

Visit the Copper & Brass Industry Exhibit in the Hall of Industry, New York World's Fair, 1940

N.Y.W.F.

*Reg. U.S. Pat. Off.

ANACONDA from mine to consumer

Anaconda Welding Rods

THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut

In Canada: Anaconda American Brass Ltd., New Toronto, Ont. • Subsidiary of Anaconda Copper Mining Company

News of the Industry

Civil Service Examination for Metallurgists and Metallurgical Engineers—In connection with the national defense program, the United States Civil Service Commission is endeavoring to secure well qualified metallurgists and metallurgical engineers for employment in the Federal Government. Examinations have been announced to fill these positions, covering six grades, with salaries ranging from $2,000 for the junior grades to $5,600 for the principal grades. The salaries are subject to a retirement deduction of 3½ percent.

Applications must be filed with the Commission's Washington office not later than August 22 if received from States east of Colorado, and not later than August 26, 1940, if received from Colorado and States westward.

Applicants must have completed a 4-year college course with major study in chemistry, physics, engineering or metallurgy. In addition, except for positions in the junior grade, they must have had professional experience in some branch of metallurgy or metallurgical engineering. The length and difficulty of the experience vary according to the grade of the position. Applicants for the junior grades need not have had experience in metallurgy or metallurgical engineering if their college degree was received in either of these fields, or if they completed certain college study supplemented by courses in strictly metallurgical or metallurgical engineering subjects. Applicants will not be given a written test, but will be rated on their qualifications as shown in their applications and on corroborative evidence.

Further information as to the requirements for the various grades, and application forms, may be obtained from the Secretary of the Board of U. S. Civil Service Examiners, at any first- or second-class post office, or from the U. S. Civil Service Commission, Washington, D. C.

» «

Western Metal Congress—At the last meeting of the Board of Trustees of the American Society for Metals it was voted unanimously to hold the **Western Metal Congress** and **Western Metal Exposition** in Los Angeles, Calif., the week of May 19th, 1941. This will be the fourth Western Metal Congress and Exposition sponsored by the American Society for Metals, the previous ones having been held in 1929, 1931 and 1938.

"The tremendous increase in industrial activity in the West, together with the extensive growth of the aeronautical industry and the fact that three years will have elapsed since the previous convention, caused the Board to feel that 1941 should be an advantageous and propitious year for another western event," said **W. H. Eisenman**, managing director of the Congress.

The 21st National Metal Congress, to be held in Cleveland, Ohio, October 21 to 25, is showing indication of being an outstanding event in the history of the cooperating societies. These societies have their programs well advanced, the American Welding Society for example has 55 papers to present at its sessions.

The National Metal Exposition is "going to town." It is at present the largest show that has ever been held in the history of the society. Over 235 exhibitors have reserved 90,000 sq. ft. of exhibit space, and three extensions of the "space available" have been rendered necessary by the demand for representation in this important exposition.

The exposition is to be held in the Cleveland Public Auditorium concurrently with the National Metal Congress the week of October 21, 1940. Hotel Statler will be headquarters for American Society for Metals; Hotel Cleveland for American Welding Society.

Personals

Frank H. Gordon, vice-president in charge of sales of **Lukens Steel Co.**, Coatesville, Pa. celebrated on July 25th his 45th anniversary with that concern. He started as an office boy on July 25, 1895. Mr. Gordon was born in Coatesville on May 27, 1878, and was educated in the public and high schools of that city. In 1903, after having held various clerical positions in the sales department, Mr. Gordon was made assistant general sales agent. Mr. Gordon was elected vice-president in charge of sales on January 28, 1928.

» «

William A. Maxwell, who has just received his degree in chemical engineering at the South Dakota School of Mines, has joined the research staff of the **Foote Mineral Co.** of Philadelphia, Pa. Mr. Maxwell, who has specialized in the chemistry of the less familiar group of elements as well as mineralogy, will devote most of his time to process development.

» «

S. Sloan Colt has been elected a director of the **General Electric Co.**, succeeding **Seward Prosser** whose resignation was announced following the meeting of the board of directors June 28. Mr. Prosser had been a member of the board of the company since February 12, 1915.

Mr. Colt, president of the Bankers Trust Co., attended Groton School, and was graduated from Yale University in 1914. He is well known in banking circles, having been a vice-president of the Farmers Loan and Trust Co., a vice-president of the National City Bank and the Bankers Trust Co., and president of the latter organization since 1931. He is a director of various insurance and industrial companies.

» «

A. Oakleigh Bush has been appointed assistant chief sales engineer of the Abrasive Division of **Norton Co.**, Worcester, Mass. Mr. Bush has been with Norton Co. for about 16 years, first in the electric furnace plant at Niagara Falls and then in the research and sales engineering departments at Worcester. In 1937 he was transferred to the Norton London office and later to the English plant at Welwyn, becoming its acting general manager in 1939. He returned to Worcester about a month ago with other American members of Norton Company's European staff.

» «

Merit in Teaching Brings Dr. Potter 1940 Lamme Medal—For his many achievements in the advancement of engineering education and its application to industry, **Dr. Andrey Abraham Potter** has been honored with the award of the Lamme Medal for 1940 by the **Society for the Promotion of Engineering Education.** The presentation was made during the annual meeting of the Society in the Claremont Hotel, Berkeley, Calif.

Now presented for the thirteenth time, the Lamme Medal honors the memory of **Benjamin G. Lamme**, a pioneer in engineering development of electric power. Among his many achievements was the design of the 5,000-hp. electric generators that harnessed Niagara Falls in 1895. At his death in 1924 he was chief engineer of the Westinghouse Electric & Manufacturing Co.

For twenty years Dr. Potter has been Dean of the Schools of Engineering and director of the Engineering Experiment Station at Purdue University. Previously he held similar positions for seven years at Kansas State College. As Professor Langille (University of California) presented the medal to Dr. Potter he read the following citation: "For his leadership in the advancement of the profession of engineering; for his devotion to high standards of teaching and his contributions to the development of engineering education; for his understanding of human nature and sympathetic interest in the work of his associates and students; for his sound judgment and skill as an engineer; and for his untiring efforts in developing cooperative relations between engineering colleges and industry."

» «

The Air Reduction Co. has announced the retirement of **William W. Barnes**, manager at Philadelphia, Pa. Mr. Barnes, who has won the admiration and respect of the entire oxy-acetylene industry, as a result of his keen insight and pleasant personality, has been active in the industry for 30 years. William W. Barnes first became associated with the oxy-acetylene industry in 1910 when he joined the Davis-Bournonville Co., as Philadelphia sales manager. He held that

William P. Barnes

position until 1922, when Davis-Bournonville merged with Air Reduction. As a result of the merger, Mr. Barnes became Airco's manager at Philadelphia—a position he has held until his retirement.

» «

Howard R. Salisbury has been appointed manager of the Air Reduction Co. at Philadelphia, Pa. Mr. Salisbury has been connected with Airco for 15 years. He was manager of Airco at Bettendorf, Iowa, for 2 years and assistant manager at Philadelphia for the past 6 years. He is also a past chairman of the Philadelphia Section of the American Welding Society. Mr. Salisbury succeeds **William W. Barnes**, retired.

Howard R. Salisbury

H. B. Seydel, formerly assistant sales manager of the New York District, has been appointed assistant manager at Philadelphia.

» «

W. Leslie Lawrence was recently elected secretary of the **Alexander Milburn Co.**, Baltimore, Md. Mr. Lawrence filled various positions with the company, first as Baltimore representative, then on national sales, and a short time ago became one of the Company's directors. He is well acquainted in the oxy-acetylene field.

Mr. Lawrence succeeds **Harvey H. Johnson**, who passed away on June 2 after serving the company for 25 years.

» «

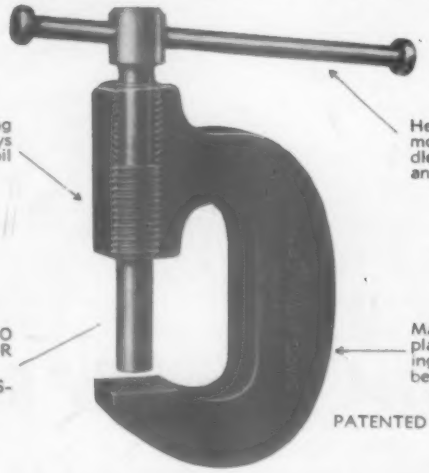
James H. Jewell has been appointed manager of agency sales by the **Westinghouse Electric & Mfg. Co.** This department is responsible for the company's apparatus products sold through distributors. Mr. Jewell was born in Chestertown, Md., and attended Pratt Institute and Temple University before enrolling in the Westinghouse graduate student course in 1920. His first assignment, after completing the course in 1922, was in the small motor section at the East Pittsburgh Works. He soon went to the Philadelphia office as sales assistant, later became a salesman in the building section and, in 1930, was made manager of the construction industry section.

After returning to East Pittsburgh in 1938 as manager of the public works and communications sections, Mr. Jewell was shortly transferred to Philadelphia as manager of agency sales of the Middle Atlantic district. In 1939 he came back to East Pittsburgh as assistant manager of the agency sales department, the position he had held until now.

"Red Head"

WELDING CLAMPS

Withstands All Welding and Handling Abuses


Heat treated for long wear. Threads always protected. Retains oil for long period.
Heat treated chrome molybdenum alloy handle offers great resistance to bending.
MAIN FEATURE
NO THREADS TO DAMAGE IN OPEN OR CLOSED POSITION.
WELD SPATTER EASILY REMOVED.
Made from solid steel plate, heat treated, giving great resistance to bending or twisting.
PATENTED

14 STOCK SIZES

Special Sizes and Shapes Furnished for Special Applications

INDESTRUCTIBLE CONCEALED THREADS

Red Head Welding Clamps have been especially designed for welding service. Their construction eliminates the trouble caused by weld spatter or accidental damage to threads. A clamp that will stand up under the most rigorous service over long periods of time.

A trial will convince you. Send for sizes and prices today.

TERRITORIES OPEN FOR JOBBERS

CHICAGO BOILER COMPANY

1965 Clybourn Avenue — Chicago, Illinois

Trade News

N. C. G. and C. I. G. Have Signed Merger Agreement—The directors of **National Cylinder Gas Co.** and **Compressed Industrial Gases, Inc.,** both with headquarters at Chicago, Ill., have approved a merger agreement, subject to final approval by stockholders on August 27, 1940.

National Cylinder Gas Co. will be the surviving company and will continue to rank as the third largest producer of compressed oxygen and acetylene in the country. Combined assets of the two companies will total about $11,000,000. According to a joint statement issued by **C. J. Haines,** president of N. C. G. and **H. B. Pearson,** president of C. I. G., the proposed merger will permit economies in production and distribution and provide greater research and service facilities."

» «

National Cylinder Gas to Supervise Rego Distribution in Three States—The **Bastian-Blessing Co.,** 240 E. Ontario St., Chicago, Ill., has extended a Rego distribution franchise to the **National Cylinder Gas Co.** in the states of Michigan, Ohio and Indiana, effective August 1st. "This move is in line with our policy to intensify selling effort," explained **E. L. Mills,** vice-president of The Bastian-Blessing Co.

"A market program has been under a process of design and field test for some weeks and is now ready for wide-spread projection. It has been decided wise to concentrate upon the heavy industrial areas of these three states within easiest marketing reach. We are happy to have been able to conclude an association with National Cylinder Gas Co. whereby they will cooperate in this effort," said Mr. Mills.

» «

Robert E. Prill Establishes Welding Consulting Service—Under the name of **Practical Welding Engineering Service,** 8216 Evans Ave., Chicago, Ill., **Robert E. Prill** has established a consulting welding engineering service to serve manufacturers and fabricators of welded products. His announcement states that he has no affiliation with any welding equipment manufacturer. He points out that this service will include: 1. Definite recommendations for production set-ups. 2. Positive procedures on any maintenance problem. 3. Salvage of any equipment by welding procedures. 4. Production speeded up to peak capacity with limited equipment. 5. Short cuts to finished products. 6. Checking designs for more economical products. 7. Safety device suggestions. 8. Jig and fixture additions to speed up production.

» «

Air Reduction Co. has appointed **Larry Dunham Motor Supply,** 213 West Coffee St., Greenville, S. C., as distributor in the Greenville trading area for oxygen, acetylene, oxy-acetylene welding and cutting apparatus and supplies. **Larry Dunham Motor Supply** will carry a comprehensive stock of Airco equipment and will be able to supply the needs of users of the oxy-acetylene welding and cutting processes in their territory promptly and efficiently.

» «

U. S. Electric Welder Corp., 1224 W. Bancroft St., Toledo, Ohio, has recently been incorporated by **J. L. Fosnight,** to acquire complete control of the USL Electric Welder Division of the Electric Auto-Lite Co. Mr. Fosnight is president and general manager. He was associated with the Electric Auto-Lite Co. for more than 24 years as sales manager of the USL Welder Division. The former USL Welder will be sold under the new trade name of U. S. Welder.

» «

Haynes Stellite Builds Plant Addition—Haynes Stellite Co. is expanding its manufacturing facilities at its plant in Kokomo, Ind., by the addition of a new 75 x 132-ft. factory building, a one-story structure of steel and brick with concrete floor and wide monitor top. Construction was started May 27 and it is expected that the building will be ready for use in August. The new building will house machinery to be used in the manufacture of Haynes Stellite alloy products: metal-cutting tools, hard-facing rods, and special castings for resisting abrasion, corrosion, and heat.

» «

The **Harnischfeger Corp.** of Milwaukee, Wis., manufacturers of arc welders and electrodes, as well as cranes, hoists and excavators, announces appointment of **Milton Kelly** of Lemon Grove, Calif., as an electrode and welder agent in this region. Mr. Kelly will operate on an open basis under supervision of the Harnischfeger Los Angeles office.

» «

Westinghouse Offers Facilities to Government—Westinghouse Electric & Mfg. Co. has "enlisted for the duration of the preparedness period" by offering its services to the United States Government. The Company has made a survey of its facilities and is prepared at once to undertake the manufacture of shells, fuse timers, lighting equipment, radio apparatus and other materials required in the Federal program of preparedness. Though the proposed program is complete in outline, it is still tentative, since the Government has so far awarded only one substantial contract. Federal officials are reported to be studying the Westinghouse proposal.

» «

Progressive Welder's New Plant Increases Capacity by 100%—Modern in every respect, Progressive Welder Co.'s new 30,000-sq. ft. plant on East Outer Drive, Detroit, Mich., which The Austin Co. designed and built, has side walls entirely of glass, except across the streamlined face brick facade behind which a large engineering department, sales, clerical and executive offices are located. Marbleized asphalt tile floors, paneled or tinted walls, glass block partitions, Venetian blinds and modern lighting fixtures, make Progressive's headquarters an excellent example of modern office and industrial plant design.

Standard machining operations required by its automatic spot welders, hydraulic punching and riveting machines, and portable welding equipment are located in a 30-ft. low aisle at the rear of the plant, where continuous steel sash admits a flood of daylight. A simi-

The Improved "Round File" Gas Lighter

Large File Area

The "Round File" construction provides a very large file area — *approximately one square inch.* This assures longer life for the lighter. The file is of superior quality and can be easily replaced.

Many superior design and construction features combine to make the Improved "Round File" the most economical and efficient lighter on the market. Get acquainted with Improved "Round File" and its many advantages.

Circular and prices on request.

SAFETY GAS LIGHTER CO. (Est. 1901) **LYNN, MASS.**

lar space on the other side of the main bay is used to machine and fit detail parts for the assembly of the welding and hydraulic punching machines which are erected in the 60-ft. monitor aisle where a 7½ ton crane expedites handling of heavy machine housings.

» «

G. E. Orders Up 40%—Orders received by **General Electric Co.** during the three months ended June 30 amounted to $115,163,267, compared with $82,188,693 in the same period last year, an increase of 40%. For the first six months this year, orders received amounted to $212,653,314, compared with $169,071,646 in the same period a year ago, an increase of 26%.

Net sales billed by the **General Electric Co.** during the first six months of this year amounted to $191,619,132, an increase of 31% over the $146,299,212 billed in the corresponding period last year. Profit available for dividends for the first half of this year amounted to $25,981,572, an increase of 59% over the $16,370,192 of profit for the same period last year.

» «

Ransome Concrete Machinery Co., Dunellen, N. J., has appointed the following exclusive sales representatives for the Ransome line of welding tables and positioners:

Wessendorff, Nelms & Co., 320 Franklin Ave., Houston, Texas, will cover various counties in Texas; **Welding Sales & Engineering Co.**, 1628 West Fort St., Detroit, Mich., will cover various counities in State of Michigan.

Also entered into non-exclusive selling arrangement with **Jones-Sylar Supply Co.**, 1800 Central Ave., Chattanooga, Tenn., who will cover that part of the State of Tennessee East of the Tennessee River.

Recent Patents

Welding Apparatus

2,205,681. **James V. Caputo**, Crafton, Pa. Filed Dec. 24, 1937. Issued June 25, 1940. For progressively welding traveling abutting plate edges, a machine is shown which has a welding throat through which the edges pass. Side-pressure rolls force the edges into firm abutment and upset them. A pair of bottom support rolls are also employed. Current is supplied by rotary-disc elements adapted to contact with the plate edges.

» «

Arc Welding

2,206,037. **George G. Landis** and **Leonidas K. Stringham**, University Heights, Ohio, assigned to **The Lincoln Electric Co.**, Cleveland, Ohio. Filed Dec. 22, 1937. Issued July 2, 1940. It is well recognized that when welding with an electric arc, many factors such as unbalanced magnetic conditions in the vicinity of the arc tend to cause the arc to behave erratically so that it does not follow the desired line of travel along the work. The inventors employ a number of electromagnets suitably located with respect to the electrode to control the welding arc. This is accomplished by the production of a directing and controlling magnetic influence over the welding arc.

» «

Welding Copper-Clad Steel

2,206,375. **Clinton E. Swift**, Milford, Conn., assigned to **The American Brass Co.**, Waterbury, Conn. Filed May 12, 1938. Issued July 2, 1940. A method of welding sheets of duplex metal comprising a base metal with a sheet of metal having a lower melting point than the base metal bonded to one side, which comprises the steps of locating the duplex sheets with edges in opposed relation with the base metal uppermost and with like layers of the two duplex metal sheets disposed on the same side, respectively, locating a filler rod adjacent to the edges and extending above the surfaces of the sheets composed of a metal having the characteristics of welding with the bonded metal and bonding to the base metal without melting the base metal, and melting down the filler rod progressively along the joint by applying a flame to the top of the filler rod and heating to a temperature to weld with the bonded metal to form a continuous lining and bond to the base metal without melting of the base metal to connect the edges. The method permits welding from only one side, which is of particular value in welding such

TITAN Provides the Correct Alloy for Every Oxy-Acetylene Bronze-Welding Purpose

TITAN Alloys—doubly-deoxidized to protect against formation of gas and oxides—give the best results for all oxy-acetylene welding and brazing applications:

Penn Bronze—is a general purpose rod. It is low melting (1620°F.) and tins easily and uniformly on galvanized, malleable or wrought iron as well as steel, brass, bronze and any other non-leaded metal with a melting point above 1850° F. It makes tough high-strength welds of high ductility, immune to strain hardening and with great abrasion and corrosion resistance.

Titan Manganese Bronze—is used where both hard and tough welds are desired. Although this is a general purpose rod, it is especially recommended for cast iron. It is free flowing and gives extremely dense, non-porous welds.

Titan Bronze—is a tin bronze with uses and characteristics similar to the manganese alloy; penetrates seams and crevices readily.

TITAN METAL MANUFACTURING CO., BELLEFONTE, PA.

TITAN BRONZE WELDING ALLOYS

The Pound of Cure That SAVES

MANGANAL

11 to 13½% Manganese Nickel Steel

APPLICATOR and WEDGE BARS replace metal faster and more economically than the customary drop-by-drop method of welding.

Applicator Bars attached, ready for filling in by use of Manganal welding electrodes.

STULZ-SICKLES CO. *Sole Producers* **91 N. J. Railroad Avenue, NEWARK, N. J.**

articles as kitchen water heaters having non-rusting or corrosion-resistant inner lining.

» «

Work Support

2,206,439. **Frank Vetorino,** Cincinnati, Ohio, assigned to **The American Laundry Co.,** Norwood, Ohio. Filed Mar. 12, 1937. Issued July 2, 1940. For supporting such cylinders as are used in washing and dry-cleaning apparatus during welding of the constituent parts together, a movable truck chassis apparatus is employed to move the work toward and from a welding tool. The machine is suitable for making a line of spot welds upon straight seams or upon curved seams. The spot welds are made at certain fixed distances from each other. A rotatable turret is employed for holding one or more work pieces and for presenting the work at suitable times for the desired operations.

» «

Welding Current Control

2,206,497. **James V. Caputo,** Crafton, Pa. Filed Apr. 4, 1938. Issued July 2, 1940. To control the starting and stopping of welding current used for welding pieces of limited length, the generator supplying the current is accelerated or decelerated, the acceleration or deceleration being timed relative to the travel of the stock material so that the flow of welding current across the seams will not be initiated until after the blank has engaged the electrode, but will be terminated before the blank has departed therefrom. A homopolar generator is used to supply the welding current, because it is adapted to deliver a large current at a relatively low voltage. A variable speed motod drives the generator and a control generator is used to apply the variable voltage to the motor driving the welding generator.

» «

Welder

2,206,549. **John E. McIntosh** and **Harold Uren,** Chigwell, England, assigned to **Briggs Mfg. Co.,** Detroit, Mich. Filed Apr. 3, 1939. Issued July 2, 1940. This patent discloses a welding apparatus having a pair of electrodes arranged for relative movement toward and away from each other. One of the electrodes is in the form of a roll. Fluid pressure is used to move the electrodes toward each other into clamping engagement with the work to be welded. An electric motor is arranged for driving the roll electrode. Valve mechanism controls the fluid pressure operating element, and controls the driving of the roll.

» «

Welding Torch

2,207,655. **Albert H. Cain,** Roodhouse, Ill. Filed June 23, 1936. Issued July 9, 1940. This patent relates to a torch using oxy-acetylene ducts and containing means for issuing a third inert gas to prevent oxide formation. The acetylene duct enters the oxygen duct. The inert gas, such as nitrogen emerges from an annular portion in the torch tip so as to form a shield.

» «

Welding Electrode

2,205,680. **James V. Caputo,** Crafton, Pa. Filed Oct. 28, 1937. Issued June 25, 1940. The inventor points out that it has been customary heretofore in practicing progressive electrical resistance welding to employ a roller contact electrode forming part of a welding throat through which the material to be welded is passed. The abutting edges of the work are heated to fusion temperature by current supplied by the electrode and the fused edges are pressed together to complete the weld. Copper has been used extensively as an electrode material due to its high electrical conductivity. The novel electrode of this invention has a conducting portion composed of copper or other highly conductive material and a pressure applying portion adjacent to the conducting portion. Independent supporting and adjusting means are provided for the conducting portion whereby, regardless of wear, it can be caused to exert sufficient pressure on the work to obtain good electrical contact.

» «

Induction Welding

2,205,425. **Samuel E. Leonard, Jr.,** Cleveland, Ohio. Filed July 7, 1937. Issued June 25, 1940. In induction welding of stock, the material is passed through an electrical field and successive opposed points along the edges of the stock are pushed together under pressure, while electrical current causes localized heat sufficient to effect a weld when the edges are pressed together. The inventor discloses an apparatus for using high-frequency currents above 5000 cycles per second for welding tubes or flat plate stock. By means of the invention it is possible to maintain the current supplied to the induction coil at a uniform frequency.

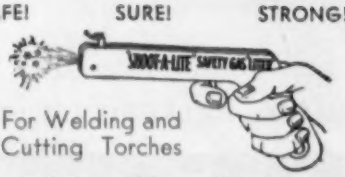
» «

Welding Rod Processing

2,205,628. **John R. Morrison,** Hudson, Ohio. Filed Jan. 9, 1937. Issued June 25, 1940. The object of this invention is to provide equipment which automatically and continuously receives and separates successive welding rods as they issue from an extruding machine. The equipment also strips a portion of the rod coating from an end of the rods and also cleans the end of the rod. These operations are carried out automatically. The end coating is removed by means of a motor-driven brush. A system of conveyors and clamps is employed to obtain continuous processing.

The Practical Lighter

SAFE! SURE! STRONG!



For Welding and Cutting Torches

Ask Your Jobber or Write us

SHOOT-A-LITE CORP.

118 East 28th St. New York, N. Y.

Trade Literature

Ergolyte Arc Welders are described in a 4-page bulletin just issued by **Ergolyte Mfg. Co.,** 3644 Lawrence St., Philadelphia, Pa. Model 160 (15 to 160 amp. range) and Model 250 (15 to 250 amp. range) are described and illustrated in the folder. Manufacturer will gladly forward this folder upon request.

Acme Spot Welders—Two types of foot-operated spot welders made by **Acme Electric Welding Co.**, Huntington Park, Calif., are described in Bulletin 50. Type-O Acme Hot Spot Welder has a stationary lower horn holder, while Type-1 has a swivel type lower horn holder. Among the features listed are reversible double-end horns, water cooled point holders, positive lock heat regulator, and positive clamping devices.

» «

The **"P & H Weld"** is the title of a new publication sponsored by **Harnischfeger Corp.**, 440 W. National Ave., Milwaukee, Wis. The new publication made its debut with the May-June 1940 issue, edited by **Edward T. Slackford** who is also advertising manager for Harnischfeger Corp. It is planned to publish the **"P & H Weld"** every other month, or six issues per year. It will be edited primarily for welding supervisors and welding operators and will be issued on a free circulation basis.

The first issue contains a feature article by **K. L. Hansen,** consulting engineer, on the subject "Why Straight or Reversed Polarity?" **E. C. Breckelbaum,** welding supervisor at Harnischfeger, has an article entitled "Low-Alloy Steels Welded with Low-Alloy Electrodes". The other articles in the initial issue comprise extremely brief reports from Harnischfeger customers in the field.

» «

All-Purpose A-C. Welder—A new four-page illustrated leaflet describing the type WT-4 portable a-c. welder, designed for all-around general utility service and production welding, has been announced by the **Westinghouse Electric & Mfg. Co.** These welders have a range of from 20 to 250 amp. and will work off of 220 or 440-volt a-c. current.

The leaflet contains a description of the unusual features of this newly developed welder. Its unique current adjustment scheme, with 27 current steps; its safety features, including low open circuit voltage and built-in circuit breaker protection. The complete set of accessories furnished with the welder is listed and shown pictorially. Complete electrical specifications, which include efficiencies, kva. input, power factor, etc., for various load current settings are given. A table of weights and dimensions, and complete ordering and price information complete the leaflet.

Copies of catalog section 26-325 may be obtained from department 7N20, **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

» «

"Flame Hardening Apparatus", a new 12-page bulletin has been issued by the **Air Reduction Co.** It makes available to the metal-working industry details on considerations and apparatus involved in flame-hardening surfaces of various forms. This new Airco bulletin described specifically the Airco Style 4383 water-cooled flame-hardening torch and the variety of extensions and types of tips available for use with it. It includes special equipment such as torch holders, adjusting arm and a discussion of the use of the Airco No. 4 Radiagraph, a portable machine especially serviceable for mounting the flame-hardening torch. Copy of this bulletin may be obtained by writing to **Air Reduction Co.**, 60 East 42nd St., New York City.

» «

Hobart Streamlined Gas Engine Driven Arc Welder — Hobart Bros. Co., Troy, Ohio., has just issued a 4-page bulletin describing its new Hobart, Jr., 200-amp. gas engine driven "Streamliner." This new unit offered on 30-day trial and also on an easy monthly payment plan is self-starting, has a separate exciter and features extra brush capacity and multiple-range economy.

» «

M. S. A. Industrial Gas Masks—The complete line of M. S. A. industrial gas masks, now supplied with the new all-vision facepiece as standard equipment, is described in an illustrated bulletin now in process of distribution by **Mine Safety Appliances Co.** In this 6-page bulletin, the advantages of the all-vision facepiece are clearly detailed, the broad range of M. S. A. canisters is displayed, and a lengthy list of gases against which protection is afforded is included.

Copies of Bulletin No. ED-7 may be obtained direct from the manufacturer: **Mine Safety Appliances Co.**, Braddock, Thomas and Meade Sts., Pittsburgh, Pa.

» «

Murex Electrode Pamphlet—An entirely new pocket-size pamphlet covering the Murex line of electrodes for arc welding has just been published by the **Metal & Thermit Corp.**, 120 Broadway, New York City. The new pamphlet gives complete data on physical properties, chemical analysis, qualifications, approvals and recommended procedures for all Murex mild steel welding electrodes, as well as similar but briefer information on Murex alloy steel electrodes. Copies may be had on request to the manufacturer.

View in Bridgeport's physical testing laboratory.

BRIDGEPORT BRONZE WELDING RODS

GIVE TOUGH, STRONG WELDS — FLOW FREELY MELT AT LOW TEMPERATURE

For general, all around gas welding, we doubt that you will find a more reliable and satisfactory alloy rod than Bridgeport Bronze.

It helps you make good, tough, strong repairs and build-ups of parts. It is especially useful for cast iron and cast steel. It flows freely at low temperatures. And it's thrifty—in first cost, in gas consumption, and with your time.

Some of Bridgeport's many fine bronze welding rods are for general purpose, others for specialized applications. All Bridgeport welding rods are made from the purest of materials carefully controlled under the strictest laboratory supervision.

Specify "Bridgeport" for Quality.

"Bridgeport" BRASS CO.

BRIDGEPORT BRASS CO.

Established 1865

BRIDGEPORT · CONN.

Classified Section

ADVERTISING RATES

Help Wanted — 75c per line, minimum 4 lines. Jobs Wanted — 4 lines free. Other Ads — $1.00 per line, minimum 4 lines. Count 8 words to line. Add 6 words for keyed address.

FOR SALE

Bargains — Demonstrator Arc Welders. Gasoline and electric drive. 30 days' trial. Easy terms if desired. Write Hobart Welder Exchange, Box U-8401, Troy, Ohio.

Business Opportunity—Completely equipped welding and machine shop with all tools for making general automotive repairs, alignment, adjustments and body work. Long established money maker. Owner retiring, will sacrifice. W. D. Burch, Agent, 1305 Atlantic Ave., Atlantic City, N. J.

POSITION WANTED

Combination Welder—Age 32, married. 17 years experience in diversified welding, pipeline, tank, structural, maintenance, hard-surfacing and manganese steel welding. Can furnish own portable equipment. Address August 1, The Welding Engineer.

Electric Welder—Beginner, 30 years of age. Lincoln factory graduate. Understand machinery, drafting, etc. Go anywhere. Desire more experience. Salary secondary. Address Guy Amodeo, 148 St. Johns Pl., Brooklyn, N. Y.

Welding Engineer, highly experienced. Resistance or arc, automatic welding, tubing or stampings. Can correct any type of trouble. Address August 2, The Welding Engineer.

MISCELLANEOUS

Best Paid Welding Jobs go to men who are best trained. Get thorough training at this non-profit arc welding school. Expert instructors, individual attention and latest type practice machines. Write today for full details and low cost. Hobart Welding School, Box U-8402, Troy, Ohio.

Looking through the camera's eye, using only the light from the welding arc.

All About Arc Welding

THE NEW HANDBOOK

YOUR GUIDE TO PROGRESS

★ Here are the results of twenty years' fact-finding on the part of a staff of two hundred arc welding experts contacting every industry throughout the world. The new 6th edition "Procedure Handbook of Arc Welding Design and Practice" contains up-to-date facts about all aspects of arc welding and its many profitable applications, compiled and edited for quick reference and easy understanding. This authoritative reference guide will enable you to keep abreast of this fast-growing industry for personal advancement and profit. You cannot afford to be without this valuable new Handbook.

Complete in every detail. In eight parts—(1) Welding Methods and Equipment. (2) Technique of Welding. (3) Procedures, Speeds and Costs. (4) Weld Metal and Methods of Testing. (5) Weldability of Metals. (6) Machine Design. (7) Structural Design. (8) Actual Applications.

Recognized throughout the world as the authentic reference book on arc welding. More than 90,000 copies of first five editions have been sold. 6th edition is an entirely NEW Handbook, containing important new information. Written clearly. Well indexed for quick reference. Size 6" x 9" x 1⅝"—ideal for use in office, shop or school. Printed on fine paper. Bound in semi-flexible simulated leather—gold embossed.

Order your copy today. Mail your order and check to

THE WELDING ENGINEER, 506 So. Wabash Ave., Chicago, Ill.

GREYHOUND
A.C. ARC WELDERS

5 Models — Ranging from 100 to 300 Amperes

Priced from $55.00 to $250.00

— FEATURING —

Five Year Guarantee
G.E. Asbestos Covered Wire
Asbestos Insulation
Scientifically Cooled
Continuous Operation
Lowest Operating Cost
Jobbers Inquiries Solicited

Mfd. by
Greyhound Electric Mfg. Co., Inc.
31 Grand St., Brooklyn, New York

Fluxes cost SO LITTLE yet are SO IMPORTANT

Use only those GOOD Guaranteed

"ANTI-BORAX" FLUXES

"A FLUX FOR EVERY METAL"

Cast-Iron Flux No. 1; Brazing Flux No. 2; "Braz-Cast" Flux No. 4 (for bronze welding cast-iron); Aluminum Fluxes Nos. 5 and 8; Stainless Steel Flux No. 9; Silver Solder Flux No. 10; Tinning Flux No. 11.

Send for Free Samples

MANUFACTURED ONLY BY
ANTI-BORAX COMPOUND CO., Fort Wayne, Ind.